SPECTRUM

Issue 1 | March 2016

SUEZ UNIVERSITY
STUDENT CHAPTER

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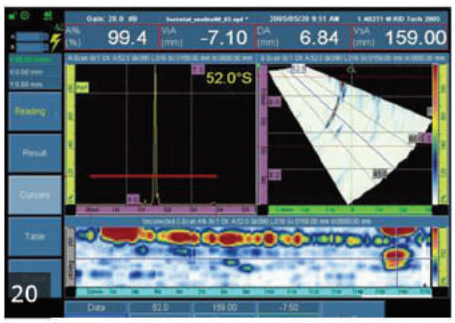

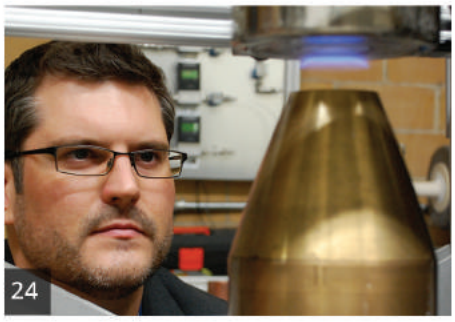

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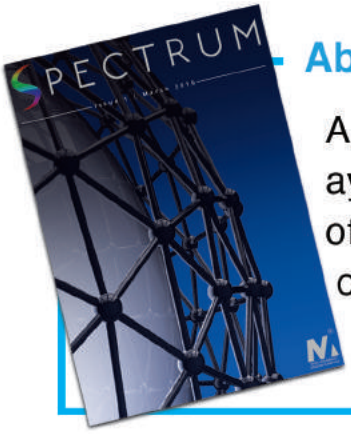

About the cover

A picture of an Atom Arr-ay-"Scientific 3D model of the molecule, an at-om of metal and glass"

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Expand Your Circle of Influence

Ahmed Mansour
Chapter President

"The key to successful leadership today is influence, not authority." Kenley Blanchard. There are two kinds of people in this world: proactive and reactive, to define these terms, we have to define the concepts of the circle of concern and the circle of influence so the first one encompasses all of your worries about your future, family, health, and extends to global issues like nuclear war. This circle contains all things which are out of your control, on the other hand, the second circle which is a part of the first one encompasses the worries that you can really have control over. Proactive people always focus on their circle of influence; they shift all of their concentration and energy to areas in which they can make difference so they are the ones who help improve the world. On the other hand, reactive people tend to concern about hopeless worries with no solution, wasting much time and energy in issues they can not change.

Being effective is based on the extent to which your radiance can go, not by having the authority over the area around you. So, the core of your influence will start by playing on people's needs not yours and knowing how much time you spend in your circle of influence, as time is a finite source and you should not waste it in vain.

Taking ownership over your life and building your influence summit are indeed difficult, but standing much time in your circle of interest may be more terrible than your fear to expand wide open. So, if you want to expand it, you should follow these steps which indeed will help. Firstly, understand and accept your needs for this turn and acknowledge that, regardless of your place, you will have your influence over people in this place. Secondly, be proactive; do not wait for the chance to knock on your door, chase it.

On the other hand, doing new things, meeting new people, making new connections, taking challenges, and giving yourself the chance to discover the unknown as challenges are the best fuel for expanding your circle of influence. Thirdly, be the permanent solution for any problem around you with no matter what the problem is, try to find a useful solution for it.

Most companies today seek behind hiring active people who have the ability to carry the responsibility of their actions, learn from their mistakes, and find ways in which they can improve their targets. If you want to start focusing on things that really matter inside your circle of influence then, you have to be a visionary by determining your goals, giving them a shape, and sound not only words, as words often go to waste, but your influence on your area resembles.

Finally, my advice to all of you is to start doing things that really matter, find yourself, take challenges, try to leave your impact, change people's life into a better one, be a leader, do not be a follower standing in a long queue, and try to be a person who will always be in people's minds.

At the end of my article, I want to say that we are a group of students who spent their time concerning about uncontrolled things, had found their way back into their circle of influence to empower students.

Today, they stand with a masterwork which indeed an evidence on their influence, by publishing the first issue of "SPECTRUM" which shows the real meaning of the expansion for their circle of influence. And from here, I want to thank each member in our beloved chapter for his belief in the power of change and his participation in empowering students. Many thanks to our fabulous heroes who have given this great magazine the opportunity to come into the light with this professional frontage and become a real spectrum light for material engineers.

Step out of The Comfort Zone

Hanan Hassan Makhlouf
Spectrum CEO

"Life begins at the end of your comfort zone." Neale Donald Walsch. This quote is a significant and meaningful phrase, one that rings a lot of bells, showing us that change is a must for your life to go on. Life moves pretty fast, and staying in the comfort zone will not help us in living it to the fullest.

Everyone, at some point, feels that they are unable to do something or are afraid of change because they feel comfortable and secure in their comfort zone, thinking that change will not work, that it will only lead to failure at the end of the road. On the other hand, I am a lucky person because I was not afraid of change; I was willing to gain new experiences and more skills like: writing, editing, time management, leadership, presentation skills, marketing, and even learning about entrepreneurship. Joining student activities four years ago was the first step for me to getting out of my comfort zone.

For us, MA SU SC founders, our vision was to do something for our department, something different, combining between professionalism and simplicity, trying to bring the image closer, and to reduce the gap between the academic and career life to help students think outside of the box, and live a life far from the lectures and subjects they are studying.

Four years ago, when I joined the faculty, I became a member in many chapters and the student union because I knew that I wanted to do something different and I started it by making a change in my personality.

For me, volunteering work is more useful than paid one as you learn to do something without a revenue; you are serving the society because you believe in an idea which is indeed worth your effort and time.

"life begins at the end of your comfort zone." A quote that implies that staying in your comfort zone means you are not living the life you deserve to live, that you have to get out of this zone and start your life in an active and energetic way.

The first step to getting out of this zone is: you have to decide first what you really want to be and what you love to do. Secondly, make the decision that you will do what you really want without hesitation, then comes the most important part which is taking your first step towards your dream and as it is shown in this fabulous quote "A dream is your creative vision for your life in the future. You must break out of your current comfort zone and become comfortable with the unfamiliar and the unknown." Denis Waitley. When you follow these steps, you will find no difficulties in your destination and achieving your goal will become easier and more applicable.

Being a member in student activities is not a waste of time as some people may say, it is an honor for everyone to be a volunteer who has the will to do something useful and to learn something new that will serve them in their upcoming life. If you are a member, try hard to learn something new and if you are a leader try hard to teach what you have learnt, because it is not about learning only it is also about spreading the idea, teaching everyone, and sustaining the spirit.

Finally, words cannot describe my happiness about this chapter and this magazine which I can proudly say, is the first magazine for metallurgical department in our faculty. These people who built this chapter from the ground did something historical and will never be forgotten, MA SU SC rings the bell for change and for everyone to step out of their comfort zone.

Interview with Ronald E. Ashburn

Executive Director, The Association for Iron & Steel Technology (AIST)

Ronald Ashburn is the first Executive Director of the Association for Iron & Steel Technology (AIST), having served in that capacity since the organization's founding in January 2004. In his role as Executive Director, Ashburn is responsible for oversight of business operations and strategic planning initiatives for AIST and the AIST Foundation. He formerly served as the eighth Managing Director of the Association of Iron and Steel Engineers (AISE) from 2002 until its merger with the Iron & Steel Society which led to the formation of AIST.

Prior to joining AISE, Ashburn worked 16 years with the German engineering firm Mannesmann Demag, a global builder of steel plants, first joining them in 1986 as a mechanical engineer in their Continuous Casting Division. In 1996, he was appointed director of technology for steelmaking and casting, and in 1997, he became vice president - casting and hot rolling.

1. Being the Executive Director of AIST, can you tell us how your journey with AIST has started and what is the impact of this experience on you?

As a mechanical engineer by education, I was employed from the onset of my career for 16 years by SMS which is a global leader in original equipment manufacturing for the steel industry. My various roles at SMS and as a young member of AIST provided me with quality trainings and a tremendous opportunity to engage with the global steel industry, specifically for the design, engineering, fabrication and commissioning of melting furnaces, continuous casters, and rolling mills.

As a young engineer, the company helped me realize how important steel is to society, the economy, and for advancing our quality of life. It also enabled me to travel the world, meet many new friends from faraway places, and experience life from many different perspectives.
Eventually, I was given the opportunity to work directly for AIST which has allowed me to leverage my industry experience to help build an association that has become a global leader in networking, education, and sustainability programs for advancing iron and steel technology.

2. How do you see the role of AIST in serving the steel industry?

AIST serves the global industry in a unique way by working to enhance the technical development, production, processing, and application of iron and steel. Our programs and services do not have national borders, and may be grouped into three key areas:
Firstly, we build networks to empower our members to leverage their collective strengths to solve technological challenges. These professional networks include our 22 member-chapters in eight countries, our 30 technology committees, and other external collaborations that advance steel technology around the globe.
Secondly, we provide training and education to advance the pursuit of our mission. AIST's 30 technology committees represent an unparalleled technical resource for all facets of steel manufacturing. The committees host training programs throughout the year that serve as forums to share technology and insights to make the industry safer, more efficient, and more sustainable.
Through our monthly publication, Iron & Steel Technology, we reach readers around the world with the latest industry news and intriguing articles that inspire a global dialogue. The pin-

nacle of our activity would be AISTech, our association's annual meeting. The conference and exhibition are the largest annual gatherings of steel industry personnel in the world. AISTech offers something for everyone in the industry including technical presentations, roundtable discussions, competitions, the presentation of distinguished association awards, and an exhibition featuring products and services from 500+ companies.
And finally, AIST is deeply committed to developing the next generation of skilled knowledgeable employees. Through the AIST Foundation, we raise much needed funds to ensure the iron and steel industry of tomorrow will have a sufficient number of qualified professionals. We fulfill this mission through an extensive offering of scholarships and grants for students and teaching faculty, presently awarding more than US$700,000 a year. Opportunities also include travel grants to help students participate in industry training programs and AISTech. In addition, we sponsor a variety contests to engage students and recognize excellence. Our commitment is strong, but we feel that more can be done. We have set expectations high to award even more scholarships and grants, and place even more interns with our companies. The steel industry has an exciting future, and we look forward to our role of building networks, providing technical education, and sponsoring sustainability programs for our membership.

3. As the Executive Director of AIST, how do you see the future of iron and steel technology?

The key to steel's future is the advancement of technology. Technology will enable the use of steel to leverage our natural resources for energy independence. Technology will enable the use of steel to achieve improved fuel consumption for automobiles, and technology will enable the use of steel to promote domestic manufacturing for generating economic wealth. The advancement of steel technology is the very basis for the existence of AIST, so our core mission is sound.
The world is demanding a more sustainable industry that makes better use of energy consumption, lessens the carbon footprint, mitigates negative impacts on the environment, and improves the communities where steel is produced. Similarly, the industry is redefining itself through the development of stronger, lighter steel grades for many diverse applications.
This march of technology will provide significant opportunity for young people. Those who succeed will be willing to work hard, work smart, and be passionate about steel manufacturing.

4. How do you see the role of Material Advantage program to students all over the world? What message would you like to leave to the chapters members?

Material Advantage is a unique opportunity that presents students with the ability to fully engage with the premier engineering-related professional organizations. Student membership is literally a "front-row seat" to getting involved and accessing tremendous member benefits. As students become members of AIST through Material Advantage, the program represents a springboard to a lifelong relationship with the Association. AIST has over 18,000 members from more than 70 countries, and accessing this network will become the most important tool in your toolbox.
Our student chapters are very important extensions of the Association. The activities conducted by student chapters are a meaningful way for students to get involved, to share their common interests in steel and engineering, and to support and learn from one another. Our message to chapters is an important one: "Be inspired by those around you, and motivated by your participation and contribution to the global steel community through AIST."

5. As AIST Executive Director, how can you see the role of AIST to serve the Middle East region especially students?

AIST is encouraged to see the development of the student chapter at Suez University. The steel industry is a vital component of the economy in Egypt, and it is important to see an interest for steel-related activities at the university level. Through our networks and educational programs, AIST will be able to enrich students who are pursuing steel and engineering-related degrees. As we develop more programming and opportunities for local students such as the International Steel Academy, we look forward to engaging even more students and professionals as members of the association.
The steel industry is a global business, and as such our global outreach is key to a sustainable organization that provides real value to our entire membership.

6. As student, what were your interests and what is your advice to students to be on the right track?

As a student, I was always interested in how things worked. I knew early in my life that math and science would be important to me, and I pursued those interests through mechanical engineering. What I came to appreciate later on was how important softer skills would become, such as developing proper communication skills, public speaking, and most importantly, how to listen.

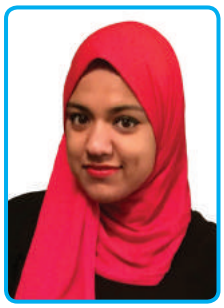
My first advice for any student is to travel. You must go beyond the classroom to really experience the steel industry. So, take advantage of every opportunity to present a paper, to attend a conference or to tour a steel plant.

My other advice to any student is to begin immediately to build your network of contacts. It's actually quite easy to do. As you go through life, who you know is more important that what you know, and your ability to call upon your network to solve problems will indeed be the most important tool in your career. Life is full of challenges, and when you learn how to solve problems, you instantly become more valuable to your company and to your industry.

7. Reaching our last question, are there any thoughts you would like to share with our readers especially since we are the first Material Advantage chapter in Egypt?

I applaud your efforts as the first class of students in Egypt to carry the Material Advantage banner. With this unique role comes the responsibility to do your best. You will learn in life that if something is worth doing, then it is worth doing right and to the very best of your ability.
As engineers, we often strive for perfection. Although we can never obtain perfection, we can achieve excellence. Be excellent at what you choose to do.

Corrosion of Metals and Its Inhibition



Nada Mohammed Azab
Projects engineer at SOPC and
Msc Researcher at Faculty of
Petroleum and Mining Engineering

Corrosion is the destructive attack of a material by reaction with its environment. Although this definition is applicable to any type of material, it is usually reserved for metallic alloys. Of the 105 known chemical elements on the earth, approximately eighty of them are metals. Half of these metals can be alloyed with other metals, giving rise to more than 40,000 different alloys. Each of them will have different physical, chemical, and mechanical properties, but all of them can corrode to some extent and in different ways. The serious consequences of the corrosion process have become a problem of worldwide significance. In addition to our everyday encounters with this form of degradation, corrosion causes plant shutdowns, waste of valuable resources, loss or contamination of product, reduction in efficiency, costly maintenance, and expensive overdesign. It can also jeopardize safety and inhibit technological progress.

Corrosion of metals and its inhibition

Corrosion can be defined in many ways, but the most preferred one is the loss of useful properties of the material as a result of chemical or electrochemical reaction with its environment. It occurs when metals are exposed to reactive environment.

Corrosive environment

Corrosive environments can include water (distilled, salt, and fresh), humid atmosphere, ammonia, hydrogen sulfide, sulfur dioxide, oxides of nitrogen, acids, and alkalis.

Aspects of corrosion

Corrosion may severally affect the following functions of metals
Many phases of oil and gas production are affected by corrosion. There are two main corrodents responsible for problems found in the petroleum industry: dissolved oxygen and acidic species, most commonly CO_2. Dissolved oxygen accounts for the corrosive nature of seawater, produced water, and also for the corrosive nature of soil. CO_2 accounts for corrosion in many oil and gas wells. When

Fig.(1): The corrosion of metallic pipe.

H_2S is present, renders problems with dissolved oxygen and CO_2 even more serious. Also, it can introduce a serious cracking problem, sulfide stress cracking (SSC), when it contacts high- strength steel that is under stress. The combined action of a corrodent with cyclic (periodic) stress can result in corrosion fatigue, a problem often found in drill pipe and in the sucker rods of pumped wells.
Corrosion resulting from corrosive soil is potentially serious for pipelines, tank bottoms, and well casings. Cathodic protection as well as offshore protection are often applicable to these cases. Offshore plat-

forms and related pipelines can result in severe potential corrosion problems that are controlled by coatings and cathodic protections. Corrosion is an economic problem as well as an engineering one. The annual cost of metallic corrosion worldwide is staggering, for example, in a 1975 study, the annual cost of corrosion in the U.S. alone was nearly 70 billion dollars. About 15% of the 70 billion dollars or 10 billion dollars was considered avoidable; i.e., it could be saved through existing corrosion-control technology. Accordingly, the cost of corrosion in the petroleum industry no doubt represents a large fraction of the total cost.
Besides the economic importance of corrosion, two other aspects make corrosion control an urgent consideration: conservation and human safety. Corrosion represents the waste of valuable resources and requires care to ensure public safety and welfare. This paper examines both the economic and engineering aspects of corrosion and its control.

Corrosion prevention

Metal corrosion can be managed, slowed, or even stopped by using the proper techniques depending on the circumstances of the metal being corroded. The main basis is by retarding either the anodic or cathodic reactions; accordingly, the rate of corrosion can be reduced. This can be achieved by several ways like: conditioning the metals and conditioning the Corrosive Environment.

Conditioning of metals

This can be divided into two main groups:
(a) Coating the metal, in order to interpose a corrosion resistant coating between metal and environment.
The coating may consist of:
(i) Another metal, e.g. zinc or tin coatings on steel.
(ii) A protective coating derived from the metal itself, e.g. aluminum oxide on "anodized" aluminum.
(iii) Organic coatings, such as resins, plastics, paints, enamel, oils, and greases.

(b) Alloying the element, to produce a more corrosion resistant alloy, e.g. stainless steel. Stainless steel is protected by an invisibly thin, naturally formed film of chromium oxide Cr_2O_3.

Conditioning of the corrosive environment

Conditioning of the corrosive environment can be sub-divided into two main groups: removal of oxygen and corrosion inhibitors.

Removal of Oxygen

In the pH range from 6.5 to 8.5, one of the main components required for corrosion would be absent by removing the oxygen from the water. It could be achieved by the use of strong reducing agents (e.g. sulphite). However, for open evaporative cooling systems, this approach is not practical since fresh oxygen from the atmosphere will have continual access.

Corrosion Inhibitors

A corrosion inhibitor is a chemical additive, when it is added to a corrosive aqueous environment, it reduces the rate of metal wastage. It can function in one of the following ways:

(i) Anodic inhibitors

It implies an anodic inhibitor interferes with the anodic process.

$$Fe \rightarrow Fe^{++} + 2e^{-} \quad (1)$$

If an anodic inhibitor is not present at a concentration level sufficient to block off all the anodic sites, localized attack such as pitting corrosion can become serious problem due to the oxidizing nature of the inhibitor, which raises the metal potential and encourages the anodic reaction as it is shown in equation (1). Anodic inhibitors are thus classified as "dangerous inhibitors". Other examples of anodic inhibitors include orthophosphate, nitrite, ferricyanide, and silicates.

(ii) Cathodic inhibitors

the major cathodic reaction in cooling systems is the reduction of oxygen.

$$\tfrac{1}{2}O_2 + H_2O + 2e^{-} \rightarrow 2OH^{-} \quad (2)$$

There are other cathodic reactions and additives that suppress these reactions called cathodic inhibitors. They function by reducing the available area for the cathodic reaction. This is often achieved by precipitating an insoluble species onto the cathodic sites. Zinc ions are used as cathodic inhibitors because of the precipitation of $Zn(OH)_2$ at cathodic sites as a consequence of the localised high pH as it is shown in reaction (2).
Cathodic inhibitors are classed as safe inhibitors because they do not cause localised corrosion.
The main types of corrosion inhibitors are shown in the next figure.

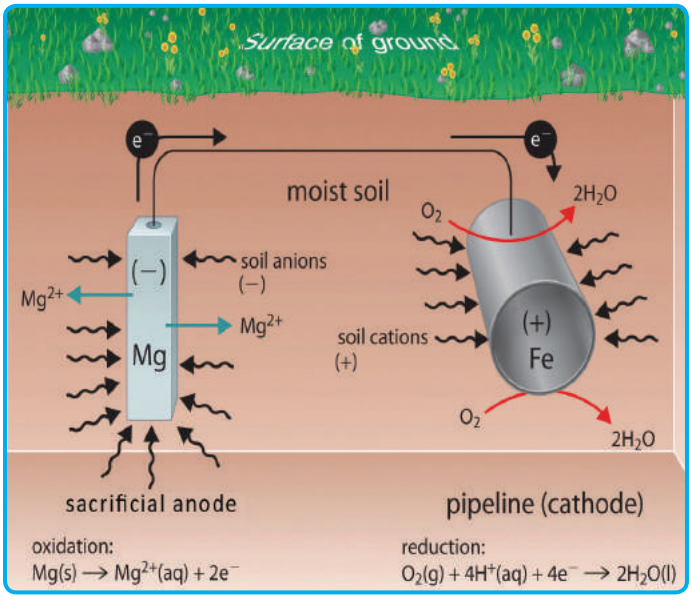


Fig.(2): The corrosion inhibitors.

In my research which is about corrosion inhibition of brass in %3 NaCl solution, I am using organic inhibitors to control corrosion which is environmentally friendly instead of the poisonous inhibitors.

Modification of Well Nozzle Size of The Tundish for CCM Machine and Its Effect on Productivity

Tarek Mohamed Elzoghbi
Production Engineer, SMP2, SSC

A modification with the well nozzle size was introduced using bigger well nozzle for more comfortable opening of the strand, and for saving more sequences due to not achievieng synchronization between EAF and CCM.

One day trip to a melt shop, CCM machine was really amazing. A complete cycle called "sequence" may take from 24 hours to 28 hours, depending on the body temperature of the tundish. then, a new tundish must be introduced to ensure good mangement at a melt shop. The main task for a shift leader is to achieve synchronization between all units of the plant especially EAF, LF, and CCM.

Tundish, as it is shown in figure (1), is used to hold the liquid steel and distribute it equally on the casting strands. it is a delta shaped container, made of a heavy welded plates lined with refractory. Delta shaped container distributes the liquid steel to the casting strands in an optimal way. It is designed to assure sufficient liquid steel residence time, in order to maximize homogeneity and minimize inclusions in the steel. Tundish is designed to use the selected steel flow control system (stopper rod, slide gate, or metered nozzle) and for either monolithic or external type of shrouds.

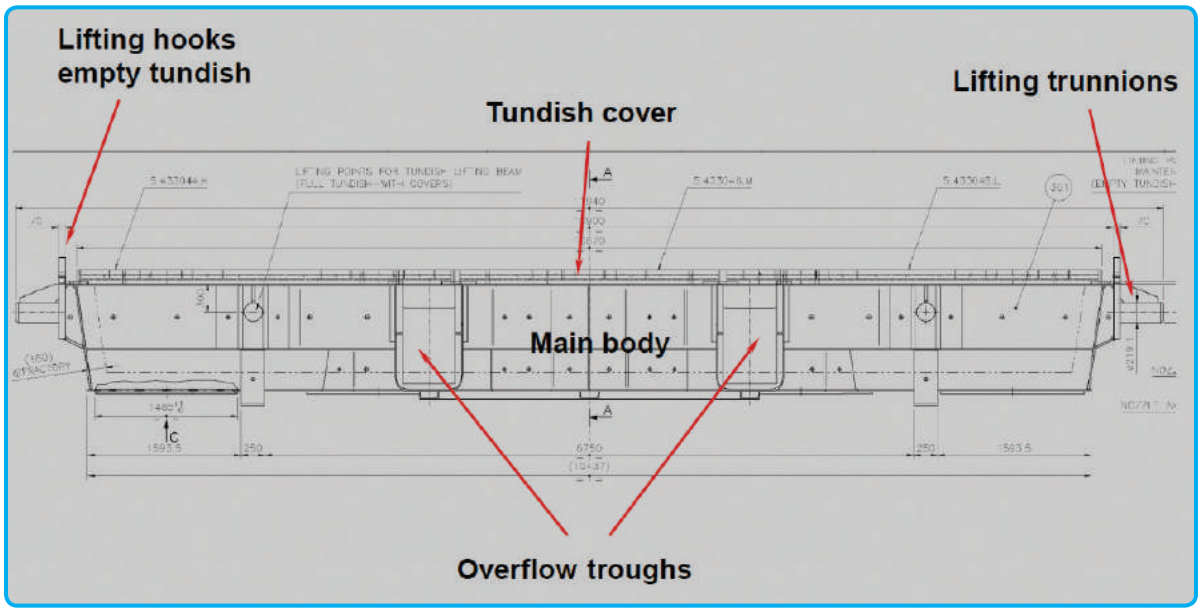


Fig.(1): Tundish.

The main characteristics for our Suez Steel SMP2 Tundish:

- **Steel level 750 mm.**
- **Overflow level 800 mm.**
- **Nominal capacity 35 t.**
- **Max. capacity 38 t.**

Our Main obstacle in SSC - SMP2, that EAF is designed for a 160 tons heat running within 58 minutes, which is the same time designed for the CCM that brings problems in short timing for maintenance in CCM. In addition, losing many sequences as heat came from EAF late, resulting in low level in the tundish. Metal loses its super heat and the small size of tundish well accelerates solidification process at tundish well. Also, the strands should be closed automatically to avoid losses.

Before requesting the starting heat from LF, be sure that no prior maintenance or simulation actions are still ongoing. A well-centerized Tundish must also be ready with no refractory pieces inside. Tundish preheating should be till 1200°C to avoid heat loss at the start of the cast, Checking all CNC instrument is also fundamental.

Now, everything is ready to start heating. Ask the LF to begin the heating sequence, put it on turrent and start pouring metal into the tundish. Using oxygen lance, we start to open the strands one by one. If there are still refractory pieces in the well of any strand, it can clog metal stream and delay opening of the strand. The tundish must be treated before to avoid this problem and this is called "Good Preparation of The Tundish". Sometimes, we may lose one strand as umbrella shape stream caused by several trials of opening strand. It may force us to repack again. Delay time will be more than 30 minutes. Also, losing one strand will affect the superheat temperature. Returning the charge with low superheated x tons back to LF/EAF is the real loss.

Depending on the final product, we may use one nozzle or two. Most steel industries, based on sections 130^2, 150^2, and 200^2, are all based on using one nozzle. Other complex products in casting usually use 2 nozzles, outline of a nozzle and its well is shown in figure (2).

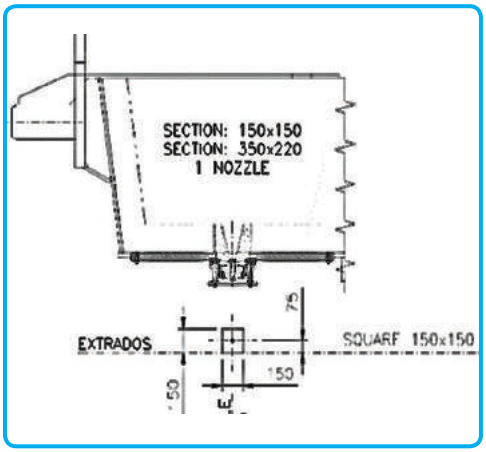


Fig.(2): Tundish nozzle.

A modification with the well nozzle size was introduced using bigger well nozzle as it is shown figure (3), for more comfortable opening of the strand. That is done by the help of the refractory staff; a hand-made funnel (with the bigger dimensions) with holding hand to help digging in refractory at the required dimensions.

After Modification, the conditions to start a sequence are:

- The starting superheat.
- The metal level in the tundish when we start to open the strands.
- The type of the stream (cylindrical or umbrella) for every strand.
- The number of oxygen lances used for opening per strand.

Results

Better opening of all strands has achieved, not only for better start, but also for avoiding automatic close of the strands as a result of lowering the superheat.

To understand how this can be done, suppose we have a metal inside a well with volume 'X' that is in case of the old dimensions, a chill of solidified metal will start to be produced on the walls of the well that will cause clogging metal and automatic close of a strand. On the other hand, with the new dimensions, holding metal with volume nearly '2X'. This volume will not be cooled as what happened with the old dimensions as it gives no chance for a big chill to be produced.

Ending sequences due to metal loss of superheat and due to heat coming late to CCM became now rarely happen, which makes it a simple and great modification. I remember before we had lost nearly 3 or 4 sequences a week for that reason. Now probability is diminished.

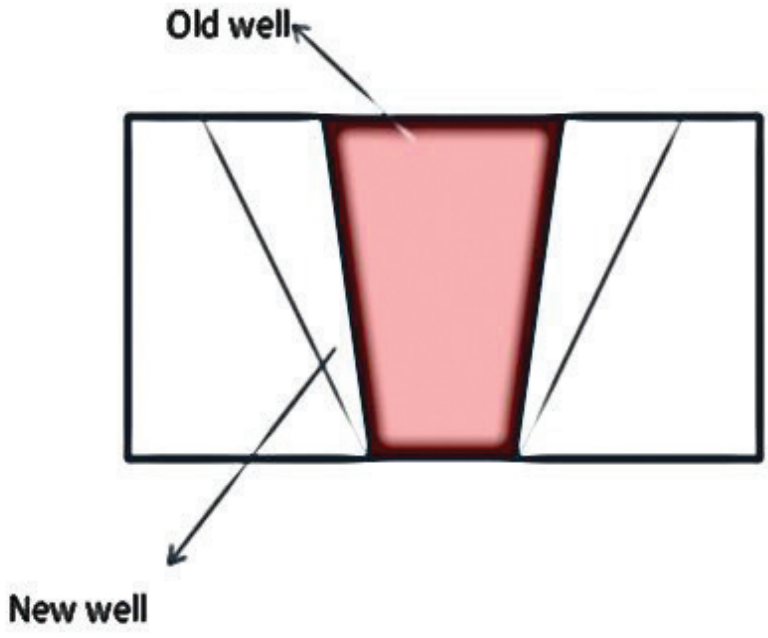


Fig.(3): Shematic reoresentation of new and old well of a nozzle

Chapter Start Up Ceremony

On the 19th of October, 2015, Faculty of Petroleum and Mining Engineering witnessed the foundation of the first international student organization enrolled in material science and engineering for the first time in Egypt and the Middle East. we were proud to raise the Material Advantage banner and represent its partner societies:

- The American Ceramic Society (ACerS).
- Association for Iron & Steel Technology (AIST).
- ASM International® (ASM).
- The Minerals, Metals, and Materials Society (TMS).

The ceremony was in a gorgeous atmosphere full of energy, fun, and inspiration in the presence of chapter's advisor, Dr. Marwa Abbas.

eMentoring Program

Knowing the requirements of the labor market is a difficult challenge for all students in Egypt but with MA SU SC, all these distances have been broken through the startup of eMentoring Program.
eMentoring Program is a way of providing students with a deep insight into their academic and career life by building a strong relationship between students and professionals. The professionals help students by sharing:
- Their career experience.
- Advices and guidance for students to reach their goals.
- Tips for improving academic achievement.
- Encouragement for career exploration.
- Resources to help students enhance their personal development.

eMentoring program had a forty mentors in its first stage.

BREAKING DISTANCES

Zewail City Visit

MA SU SC had the honor of organizing a visit to Zewail City of Science and Technology on 14th of December, 2015.

Zewail City of Science and Technology is an independent institution of learning, research and innovation in Egypt which aims to contribute to build a knowledge-based society founded on creative thinking.

The visit started with a free tour to explore the city especially Nano-Technology Research Center, then a presentation by one of Zewail's esteemed professors. After that, we had a walking tour to explore Zewail different facilities including: the chemistry and physics laboratory.

INJAZ Egypt Partnership

From our fruitful partnership with one of the most well-known educational organizations, Injaz Egypt, MA SU SC succeeded in organizing two fabulous programs: ICamp and Steer Your Career.

The two programs help to inspire, empower, and prepare Egyptian youth, enhancing their opportunities to join the job market as qualified employees and entrepreneurs. The two programs went through the essential skills needed for students to function successfully in today's workplace.

They also covered aspects of leadership, time management, communication, critical-thinking, team dynamics, and job search skills. It was a great success for us to deliver the value of these programs to more than sixty students in each program.

iMetallurgist Program

As we believe that MA SU SC has a message toward not only university students but also young youth all over Egypt, it was essential to reach students in middle and high schools through a unique outreach program "iMetallurgist" which provides students with the opportunity to take a closer look at the Engineering field, especially Material Science and Engineering filed, and encouraging them to get a degree in this filed through attractive presentations and practical applications that show the power of materials in our life.

MA SU SC has visited five schools till now with a great acceptance from students giving us strong incentives to reach every student in Egypt.

Visiting Egypt plants

Giving students the opportunity to apply theoretical knowledge in actual work and experience practical work by themselves is always our main concern. In order to achieve that, MA SU SC had organized number of visits to the most leading plants in Egypt like: Ceramica Cleopatra, Cairo Oil Refining Company, and Qarun Company. These visits helped the students to see the clear picture of the theoretical things they have learnt so far and managed them to meet the future employers. It also managed them to understand the challenges that they might face during their future work.

Pizza Day

MA SU SC had a great surprise for its members during chapters general meeting by offering free pizza meals and snacks sponsored by our partner society AIST. The days atmosphere was full of joy and excitement leaving our members more motivated and even more determined to achieve an extra-ordinary year full of advantages to all material students and engineers all over Egypt.

Schlumberger

HSE workshop with Schlumberger

According to our vision to open new horizons for students and to achieve their needs, we have a partnership with one of the leading companies in oil industry worldwide, SLB company. The deal is to organize a workshop about HSE (Health, safety, and environment).

The day will go through important topics oriented about HSE management system inside SLB.

The Cement Production Drop Problem (Causes and Solutions)

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Research Assistant at Faculty of Petroleum and Mining Engineering

Bassant Elbestawee
Metallurgical Engineer and Commercial Diver

Energy is one of the basic sources of life, not to mention its importance to industry. Due to the latest global circumstances, energy became very sensitive and strategic case for every country. Egypt, for example, suffered from fossil fuel shortage in the last few years, which make studying alternative fuels a must.
Alternative fuels are not a new technology to the world. Almost all kilns in UK, France, Belgium, Holland, and Germany are now using alternative fuels with substitution rates reaching 80 to 90% in some cases.
This case study approaches the problem of production drop due to natural gas shortage as well as the possibility of suitable solutions application. In addition to further description of some examples to the alternative fuels.

The causes of production drop has three categories

1. Mechanical or electrical

Any mechanical or electrical problem in any part of a machine may lead to a temporary decrease of productivity. These problems can be in conveyors or crushers; it is discovered by alarm in the CCR.

2. Production

It results from the problems in the material flow. For example, the dust in reclaimer which piles up and hinders its path or in the kiln rings (build-ups) that forms at the lining of the kiln and decreases its diameter, which limits the material flow as a result of a failure in the ratios of the input feed materials mixture of the kiln.

3. Circumstances

Such as the natural gas shortage problem, which is a result of the circumstances of Egypt nowadays.
The kiln feed of natural gas decreases from 21m^3/hr to 18 m^3/hr, so the kiln output of clinker per day decreases from 4750 t/day to 4250 t/day. Accordingly, the production decreases to be 80% of the full production capacity.

Solutions

The main idea is to apply a supportive energy source that is suitable for the operation conditions and become economically acceptable.

Alternative fuel

Recently, most of heavy industries companies have changed its destination to the alternative fuel.

The use of alternative fuels in cement manufacture is also ecologically beneficial for two reasons: the conservation of non-renewable energy and the reduction of waste disposal requirements. The use of alternative fuels in European cement kilns saves fossil fuels equivalent to 2.5 million tons of coal per year.
The process of clinker production in kiln systems creates favorable conditions for the use of alternative fuels, these include:

- High temperature.
- Long residence time.
- Oxidising atmosphere.
- Alkaline environment.
- Ash retention in clinker.
- High thermal inertia.

Types

Gaseous: refinery waste gas, landfill gas, pyrolysis gas, and natural gas.
Liquid: tar, chemical wastes, distillation residues, waste solvents, and oil sludge.
Solid: petroleum coke, paper waste, rubber residues, and rice husks.

Principles to be considered to apply the A.F

Cement quality

The product quality is one of the highest priorities for large companies, so the application of A.F can not affect the cement quality.

Human health

It can not be harmed by any toxic emissions or gases.

The co-processing companies

They should have high quality standards.

Rice husks

The rice husks are found in Egypt in large quantities and burning it every season is one of the most serious environmental problems in Egypt because of its CO_2 emissions.

Fuel	CV (MJ/kg)	% biomass	Preparation	Availability in Egypt
Paper and plastic waste mixtures	17–20	50%	Removal of metal and shredding	Already recycled in the informal economy
Selected and processed streams from municipal waste (RDF)	13–15	50%	Removal of metal and inerts, shredding and drying	A prospective fuel for Egyptian cement companies
Animal meal from a rendering process	18–20	100%	Residues from a rendering process	Already recycled in the informal economy
Sewage sludge	12–14	100%	Drying and fragmentation	Small quantities
Car tyres	28–30	20%	Shredding	Small quantities
Wood waste	12–14	100%	Size reduction	Small quantities
Agricultural wastes (rice straw, cotton stalks, maize cobs)	13–15	100%	Shredding	Available in large quantities but dispersed over large area

No	Governorate	type	Jan-May ton	type	June-Aug. ton	type	Aug.-Nov. ton	type	Nov.-Dec. ton	total
1	Alexandria *	Sugar husks	5	maize stalks	18,282	Rice straw	3,814	cotton stalks	5,701	27802
2	Elbehera		260		96,159		197,994		103,957	398370
3	EL ghrbya		1,246		35,951		151,732		20,519	209448
4	Kafer elsheikh		76		28,705		304,557		77,822	411160
5	Dakhlya		284		30,652		416,038		53,480	500454
6	Detmta		22		1,135		62,896		5,726	69779
7	Elshrkya		30		107,362		287,629		34,543	429564
8	El esmaalya*		0		20,308		4,014		827	25149
11	El mnofya		26		86,798		0		4,636	91460
12	El kalubaya		627		40,104		23,053		1,821	65605
total North area- Egypt			2,678		468,524		1,469,960		310,684	2251846
15	El Giza		4,082		37,077		0		0	41159
16	Bani swuif		2,488		227,173		1,270		16,367	247298
17	El fayoom		1,077		86,403		25,715		19,900	133095
18	Elminya		100,428		400,511		0		11,484	512423
total of middle Egypt			108,075		751,164		26,985		47,751	933975
20	Asuit		4,692		174,437		165.0		9,778	189072
21	Sowhag		35,275		173,060		0.0		2,908	211243
22	Qena		330,004		72,714		0.0		0	402718
23	Luxour		50,830		19,031		0.0		0	69861
24	Aswan		172,596		18,319		0.0		0	190915
total of upper Egypt			594153		548,323		7,372		18,137	1,167,985
total waste can collected			638,303		1,543,275		1,487,818		331,483	4,000,879

The plant location in Alexandria recommends Elbehera and Alexandria to be a source of the rice husks to reduce the cost of transportation.

The price at the plant is about 270 EGP/ton. The calorific value = 3100 kcal/kg.

To apply the AF system, there is a needed equipment such as: metal detection, storage system, shredding machine, and conveying equipment.

Issues of rice husks

1. Low density (large volume result in storage problems). This can be solved by compression into blocks after shredding.
2. Low calorific value in comparison with natural gas but with production increase, the benefit will overcome this problem.
3. High alkaline content and this can affect the chemical ratios of the clinker so the combustion is done outside the kiln and the heat is supplied by the means of heat exchanger.
4. Sesonal product, so it is not available anytime of the year, but storing large amounts can overcome this issue.

Assumptions

1. Current annual clinker production in Egypt = 50 MT.
2. A target of 30% substitution by A.F.
3. A kiln fuel efficiency of 3.5 GJ/t clinker.
4. An agricultural waste fuel CV of 14 GJ/t.
5. Four million tons of alternative fuel is required.
6. 2.9 MT of rice husks are required.

Flare gases

A gas flare, alternatively known as a flare stack, is a gas combustion device used in industrial plants such as petroleum refineries, chemical plants, natural gas processing plants as well as at oil or gas production sites having oil wells, gas wells, offshore oil and, gas rigs, and landfills.

In industrial plants, flare stacks are primarily used for burning off flammable gas, released by pressure relief valves during unplanned over-pressuring of plant equipment during plant or partial plant startups and shutdowns. Flare stacks are also often used for the planned combustion of gases over relatively short periods, so it can be used as supportive source of heat energy.

The flare gas can be brought from the refinery plant to the cement plant by pipelines, then the combustion takes place to give the heat to the heat exchangers and then to the pre-heaters.

Examples of near refineries

AMOC, ANRPC, ACPA, ELAP, and Alexandria Petroleum.

Advantages

The main advantage is the location of the cement plant near many refineries which reduces the transportation cost and make the idea economically effective.

Conclusion

Using alternative fuels in cement industry is not only a solution for fuel shortage problem, it will also lead to tremendous economic and environmental benefits.

There are many resources for alternative fuels that can be exploited. In this case study, rice husks and petroleum refinery flare gas were very promising resources, due to the industry requirements and the factory location.

Measuring The Effect of Mass Scaling of a Rolled Strip during The Production of Steel Rebar

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Mass scaling was studied in this simulation to measure its effect on the model validity and the rolling simulation outputs accuracy, when it is used as a technique to speed up the time of rolling simulation running and decrease its computation cost.

Finite element analysis software, used to determine the validity of rolling models, mainly offers two analysis modules: the explicit and the implicit solver. Explicit analysis complies with the law of momentum conservation, when taking the inertia effect into account, in contrary to the implicit method, which does not take the inertia effect and compensate for such error by solving the equation with iteration method.
The following explicit equation is used to calculate the displacement and strain with its corresponding flow stress of the elements of rolled object:

$$MU = P - I$$

Where 'M' is the mass matrix, 'U' is the nodal acceleration, 'P' is the applied force, and 'I' is the internal forces. The accelerations are integrated through time to calculate the change of velocities assuming "constant accelerations ". The resulting velocity is then integrated through time to determine the displacement of element nodes at the end of the increment. The critical value for 'Δt' is expressed by Courant-Friedrichs-Lewy condition 'CFL', which is:

$$\Delta t \leq L/C$$

Where 'Δt' is the stable time increment, 'L' is the smallest element side length and 'C' is dilatation of speed through the material, as shown in Figure (1).

According to the above equations, the condition must be satisfied to get stable solution. The dilatation of wave speed depends on the density of the material as well as Young's modulus. So, scaling the mass to a higher density, for the entire model, gives a faster analysis.
The current work shows the effect of using mass scaling to the rolled object and state the corresponding error in calculating the state function and energy assessment of the rolled strip and its effect on the model validation.

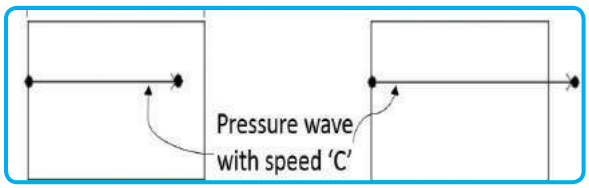

Fig.(1): Time increment 'Δt' in the same element length 'L' with two different pressure wave speeds 'C'.

Method

Mass scaling was tested with two models, employing "ABAQUS" FE program. The two models had the same verifications, instances, and boundary conditions except using mass scaling factor equal to 5000 in one of them. The strips had a mesh density of 17600 elements/strip, 100 mm long and 24.5 mm width for each strip with element size 1.5 mm of the type "C2D8R", as shown in Figure (2). The material behavior was based on elastic-plastic deformation model of the Egyptian steel grade B400B at temperature of 1200°C. The boundary conditions were based on a full part modeling without

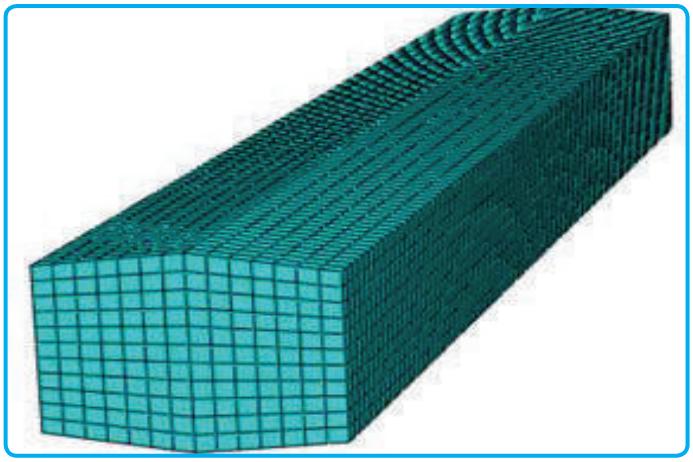

Fig.(2): Rolled Strip geometry and discretization.

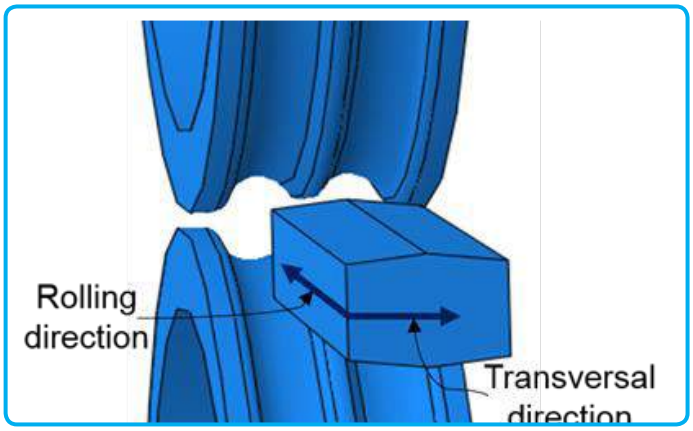

Fig.(3): Model instance assembly.

The strip enters the rolls, which have an angular velocity of 54.4 rad/sec, at an initial speed of 1500 mm/sec. The contact interaction was modeled by a penalty contact and tangential friction with coefficient of friction that is equal to 0.4.

Results

The comparison in time increment and computation time values, shown in table (1), shows the effect of mass scaling. The geometry of rolled strip after exiting the dog bone pass were shown in figure (4). Lastly, the rolling power calculation and validation comparison were shown in figure (5).

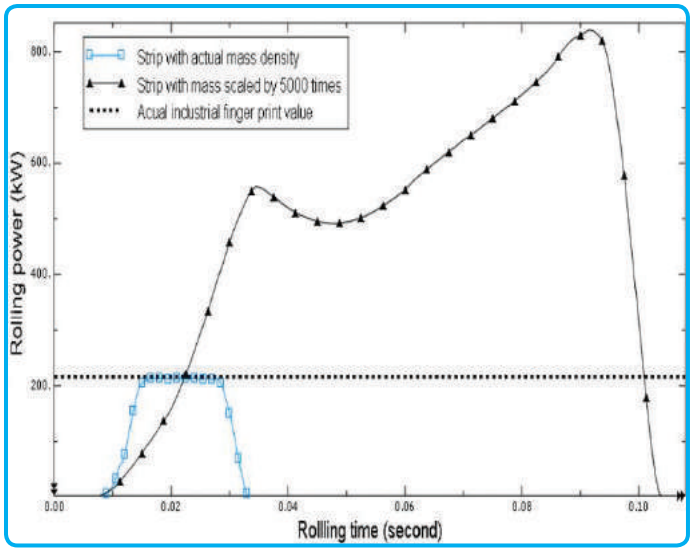

Fig.(5): Shows the calculated rolling power and compared with industrial finger print value.

Model validation

As shown in figure (5), the model (without mass scaling) was compared with an industrial finger print data in a rolling mill, at Ezz Steel plant, composed of 18 rolling stands. A good agreement was found between the calculated rolling power and the experimentally measured one, which provides satisfying validity for it.

Discussion

As shown in table (1), mass scaling was found to reduce the computation time from 121 to 7 minutes which is considered a large saving in the computation cost, but with corresponded incorrect rolling power calculations and geometric inhomogeneity of the rolled strip along its length as shown in figure (4).

Conclusion

In the final analysis, mass scaling was found to be useful in the verification stage when multiple runs were needed to test the model, but on the other hand; it should not be used at the final run, in order to get final reliable calculations.

	Without mass scaling	With mass scaling 5000
Computation time (min)	121	7
Average time increment (sec)	$1.014e^{-7}$	$6.8e^{-7}$

Table (1): Shows the effect of mass scaling.

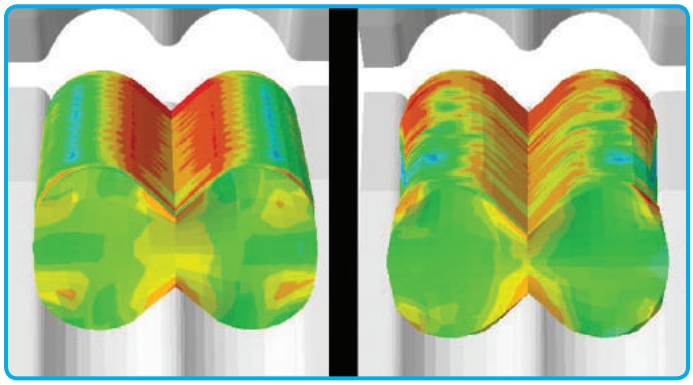

Fig.(4): shows the geometry comparison between the two strips.

References

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[2] Abaqus Version 6.13.1, Documentation.
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[4] Feixia Pan, Jiansen Zhu, Antti O. Helminen, Ramin Vatanparast, 9th international LS-DYNA users conference, 13, 31- 42.

PAUT (Phased Array Ultrasonic Inspection)

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The world is going so fast. Every day, in all fields, new technologies appear and old ones vanish. Inspection Engineering is one of those fields. In general, inspection is divided into two main categories: destructive testing and non-destructive testing. Non-destructive testing includes many types, but the main five methods are:

- Dye penetrant testing (PT).
- Radiographic testing (UT).
- Visual testing (VT).
- Magnetic testing (MT).
- Ultrasonic testing (RT).

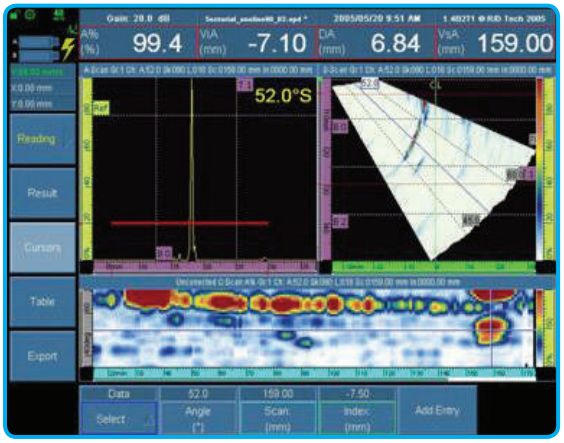
PT and MT are used in inspection of surface defects. RT and UT are used in inspection of volumetric defects and VT. The most common and the most important inspection method is used in inspection of surface defects and welding monitoring.

For many decades, RT was the main method for inspection of volumetric defects over UT. The main advantage of RT is the presence of a permanent record, the radiograph film. Other advantages of RT are the ease of interpretation and evaluation of the film that can radiograph up to 80 mm thickness welds, which is excellent for small thickness welds. One main disadvantage of RT is safety as it uses radioactive sources like cobalt or iridium to radiograph the weld, which are very dangerous to one's health and it needs a lot of precautions to use. Other disadvantages of RT are: it takes a long time to radiograph and develop the film, it can not radiograph thick welds more than 80 mm, its sensitivity to cracks is low, it can not determine the depth of the defect, it produces chemical wastes, and it needs licenses from authorities to move the source.

UT is a very good method for inspection, but it has two main problems: first, it depends on the orientation of the defect inside the weld respective to the angle of the sound beam used. And the second, it needs a very experienced and skillful inspector to differ between true and false indications from the weld. Also another disadvantage of UT was the absence of a permanent record.

As time goes, other techniques appeared as advanced techniques for inspection as TOFD (time of flight diffraction) and PAUT (phased array ultrasonic). Phased array is considered a break-through in the field of inspection. It has both advantages of UT and RT with a higher POD (probability of detection) for flaws. Phased array is considered a development for ultrasonic; it depends on the main scientific idea as conventional ultrasonic.

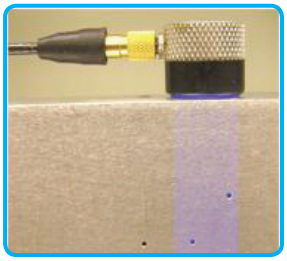
Phased array ultrasonic uses a range of angles instead of a single angle. Also, it provides a permanent record; it uses more than one scan at the same time (e.g. A-scan, B-scan, C-scan, S-scan, R-scan, etc.). It can determine the exact depth, length, and height of defect unlike RT and it has 85% POD, which is a very high in comparison with UT or RT.



For the conventional ultrasonic, it uses a piezoelectric transducer to generate wave. Piezoelectricity is pressure-induced electricity.This property is a characteristic of certain naturally occurring crystalline compounds and some man-made materials. As the name piezoelectric implies, an electrical charge is developed by the crystal when pressure is applied to it. Conversely, when an electrical field is applied, the crystal mechanically deforms (changes shape). The most common types of piezoelectric materials used for ultrasonic search units are quartz, lithium sulfate, and polarized ceramics such as barium titanate, lead zirconate titanate, and lead metaniobate. Waves are transmitted to materials through couplants. They are produced with a certain single angle.

Ultrasonic phased array consists of a series of individual elements instead of a single crystal. Each of them has its own connector, time delay circuit and converter. Elements are acoustically insulated from each other. They are pulsed in groups with pre-calculated time delays for each element (i.e., "phasing"). By combining these pulses through constructive interference, they can produce a certain angle.

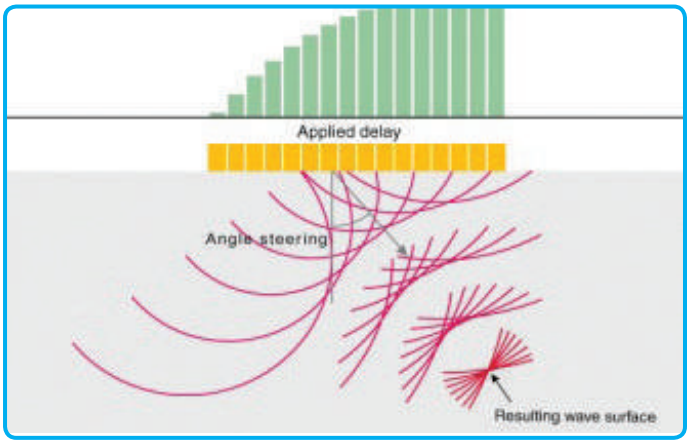
For beam forming, when no time delay is applied between each element (elements in the array are yellow and the delay applied to each element is in green), a PA probe becomes like a conventional UT probe.



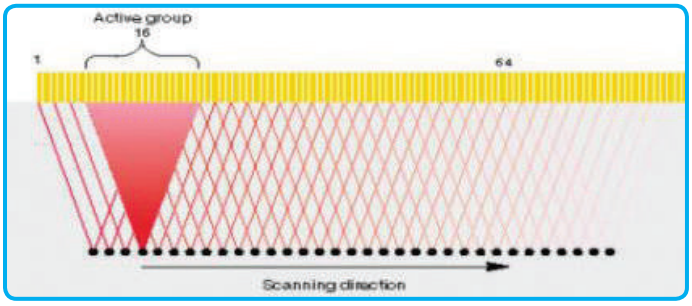
For Beam Steering, it Provides the capability to modify the refracted angle of the beam generated by the array probe and allows for multiple angle inspections using a single probe; also, it applies symmetrical (e.g., linear) focal laws.

For beam focusing, it Provides the capability to converge the acoustic energy onto a small focal spot, and it allows for focusing at several depths using a single probe and and applying a symmetrical (e.g., parabolic) focal law for a normal beam.

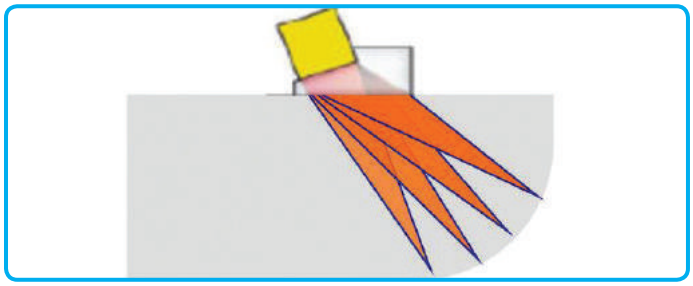
By combining both steering and focusing focal laws (delay applied to each element is in green), the focal point can be angled.



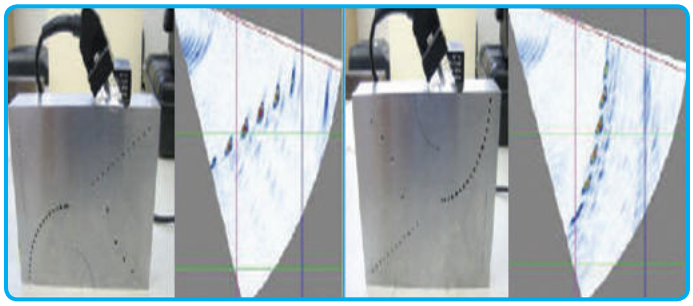
Phased array has different scanning types. First, the linear electronic scan; the movement of the acoustic beam is along the axis of the array without any mechanical movement. The beam movement is performed by time multiplexing of the active elements. Arrays are multiplexed using the same focal law.



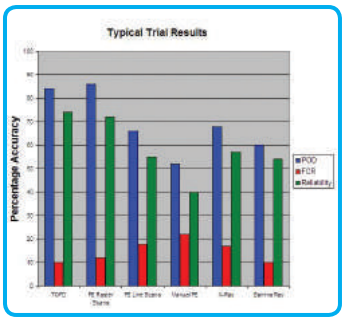
Second, the sectorial scan; the ability to scan a complete sector of volume without any probe movement. Useful for inspection of complex geometries or geometries with space restrictions. It combines the advantages of a wide beam and/or multiple focused probes in a single phased array probe.



Phased array uses a range of angles -not a single angle- to cover all the weld, for example, angles between 45 and 70 with a step 1 degree.



Ultrasonic phased arrays are used in a wide variety of industries where the technology has inherent advantages. These industries include: Aerospace, Petrochemical, Automotive Pipe mills, Steel mills Pipeline construction, Nuclear power, and General manufacturing, construction and a selection of special applications.



Phased array now is replacing RT all over the world. Here in Egypt, phased array started to work on 2011. Now, in 2015, it has been introduced into many companies and in so many industries like power stations, petro-chemical industry, in-service inspection, cement industry, and gas stations. Business wise, phased array is much more economic than RT as it saves a lot of time; time of radiographing, developing, and processing of films, which consequently, remarkably, directly, and indirectly decreases costs of inspection.

The Story of Steel and Its Effects on The World

Ahmed Eltantawy
Junior Student at Faculty of Petroleum and Mining Engineering

Since the beginning of history, humans were distinguished from other creatures by the ability to use tools and even fashioning it to serve a definite purpose; the different needs of these tools divided the humans' history to the three-age system of archaeology, based on the discovered metals in each period. The first period of the three-age system was the stone age, when humans used stones to create their implements. About 3500 BC, it was discovered that by combining copper and tin, a new harder and more durable material than previously possible ones was produced. After 2000 years later, the meteoric iron was discovered in Egypt and Mesopotamia and was called "gift of the gods". This gift opened the door for the invention of the most important alloy throughout history, which is steel alloy. Even though it was 4000 years ago since the beginning of iron age, steel is still considered a new material because every day there is a new kind of steel with new properties felicitous for a new application or as a replacement of an existing one.

Invention of steel-iron and charcoal came together at a date back to the 13th century BC, when the early blacksmiths discovered that iron becomes harder and stronger when left in charcoal furnaces. The "black" in "blacksmiths" refers to the black fire scale, which forms on the surface of the metal during heating. The origin of "smith" may come from the old English word "smythe" meaning "to strike" or it may have originated from the Proto-German "smithaz" meaning "skilled worker". The main method they used to create steel products was forging. They used many tools to hammer, bend and cut the materials and produced a range of products such as: gates, grilles, railings, light fixtures, furniture, sculpture, agricultural implements, decorative and religious items, cooking utensils, and weapons.

At the 6th century BC, the crucible steel production process started at production sites of Kodumanal in Tamil Nadu, Golconda in Telangana, Karnataka and Sri-Lanka and exported globally. The "Wootz Steel", which is still admired today, was made by using crucibles to smelt wrought iron with charcoal in southern India at the 3rd century BC.

In the Roman era, the progress in steel production came with the war, when the imperial armies of China, Greece, Persia, and Rome were in need to manufacture durable weapons and armours as it is shown in figure (1). The war forced the Romans to learn how to temper work-hardened steel to reduce its brittleness.

Fig.(1): An ancient roman armour.

At the 3rd century AC, the ancient China developed a lot of techniques and instruments we use now in steel industry like the innovation of the blast furnace, also a new grade of high quality steel was produced through a process called "Bessemer process", which was only developed in Europe in the 19th century.

The Arabs developed a new kind of steel based on the Wootz Steel, which was called "Damascus steel".

The invention of Damascus steel was in the 11th century and it was describing a grade of steel, which was used in sword-making as it is shown in figure(2).

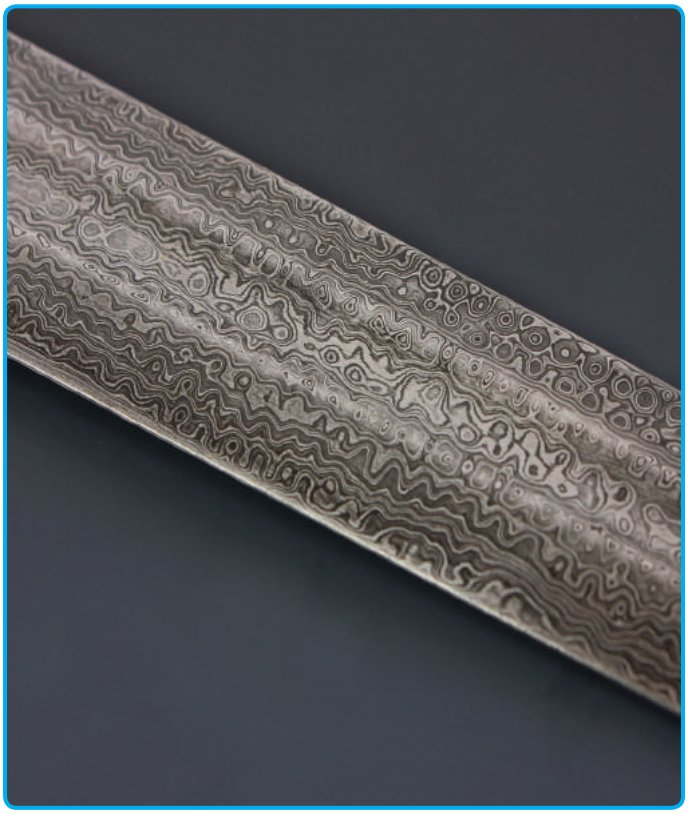


Fig.(2): Damascus steel sword

Sweden leaded the steel production in the 18th century and new techniques began to emerge to improve the quality and consistency of steel. During this time, expensive and beautiful steel was produced in limited quantities by artisans.

In 1740, the English inventor Benjamin Huntsman developed the crucible steel technique to produce a steel with higher quality. 43 years later, Henry Cort invented the steel roller for steel production. The rolling mechanism was also developed after eleven years by introducing the ball bearing technique.
From 1837 to 1855, agriculture became an industrial purpose, particularly in the virgin land of the US, where the steel plough greatly accelerates agricultural development. Steel was used for irrigation, planting, and harvesting.

The Bessemer process for steel manufacturing, which fired the steel industry for more than 150 years, was invented by the famous engineer Henry Bessemer. The Bessemer process was the first inexpensive industrial process for the mass-production of steel from molten pig iron. The process had also been used outside of Europe for hundreds of years, but not on an industrial scale. The key principle is removal of impurities from iron by oxidation with air being blown through the molten iron; the oxidation also raises the temperature of the iron mass and keeps it molten.

The 60s of the 19th century witnessed the foundation of the railways in the US, also steel began to remove iron in most industries. The outbreak of the American civil war made the American steel industry grew with astonishing speed. At the end of this century, the first skyscraper “caleed ten stories” was built in Chicago and The Brooklyn Bridge in New York City (first steel wire suspension bridge) was opened, as it is shown in figure(3).

Fig.(3): Brooklyn Bridge

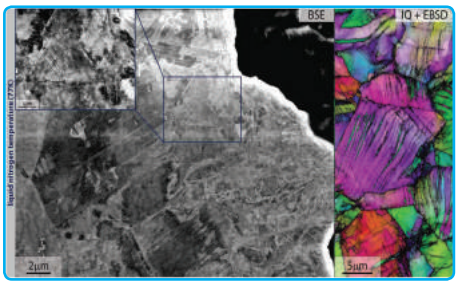
Due to the high demands for military equipment during the 20th century, there was a significant growth and nationalization of the steel production. Major developments were made in steel processing in the 1950s and 1960s, which allowed the steel production to shift away from the military to cars and home appliances. Over the same period, the electric arc furnace was employed to melt the iron and the continuous casting process was used to let the molten metal to be solidified into a semi-finished billet, bloom or slab for the subsequent rolling in the finishing mill.
The mini mill revolution was started in 1969, when one of the largest steel producers in US (Nucor) decided to enter the long products market. Russia had been the world’s biggest steel producer before the fall of Berlin Wall in 1989, which followed by the collapse of the Soviet Union.
In 2006, ArcelorMittal became the first global and largest steel company in the world from the takeover and merger of Arcelor by Mittal Steel. 5 years later, Nippon Steel merged with Sumitomo Metal to become the world’s second largest steel company in the world, Nippon Steel & Sumitomo Metal Corporation. Although the steel went stainless steel in 1912, the invention of stainless steel was officially 100 years old in May, 2012 and was normally attributed to Harry Brearley from Sheffield.
Recently, in 2014, world crude steel production reached 1,665 million tons (Mt), up by 1% compared to 2013, which is a record for global crude steel production. China has also driven growth, registering a marked increase in production. To reduce costs and increase competitiveness, many large steel producers are collaborating on the improvement of production technologies. From an environmental viewpoint, the industry remains a notable emitter of carbon dioxide (CO_2), accounting for around 30% of all industrial CO_2 emissions in the EU, but during the past 20 years, the energy required to produce a ton of steel has fallen by 40%, and throughout the 1990s there was a reduction of 20% in CO_2 emissions for the industry.
As it was shown, steel production is considered the backbone of any developed country and one of the most important industry affecting deeply on the economy worldwide. It is 20 times higher as compared to production of all non-ferrous metals put together. There are altogether about 2000 grades of steel developed. Of which, 1500 grades are high grade steels. There is also still immense potential for developing new grades and generations of steel with varying properties. One thing that is certain is that steel has a major influence on our lives; the list of steel uses is endless and undoubtedly clear. Finally, we can say that human civilization would not have been developed without the use of steel.

Acknowledgement

I would like to express my special appreciation and thanks to my advisor Professor, Dr.Tarek Allam; you have been a tremendous mentor for me. I would like to thank you for encouraging my research and for allowing me to grow as a researcher.

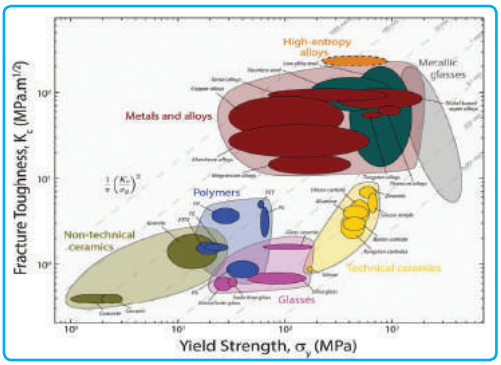
A Metallic Alloy That becomes Tougher and Stronger at Low Temperatures

The Berkeley National Laboratory has developed an alloy which becomes tougher and stronger at low temperatures. It is also tough and strong at room temperature which acquires its excellent ductility, tensile strength, and resistance to fracture.



The new alloy is composed of chromium, manganese, iron, cobalt, and nickel. Under transmission electron microscope with load applying, the alloy, unexpectedly, shows activation of bridging mechanism in front of the cracks inhibiting their propagation.

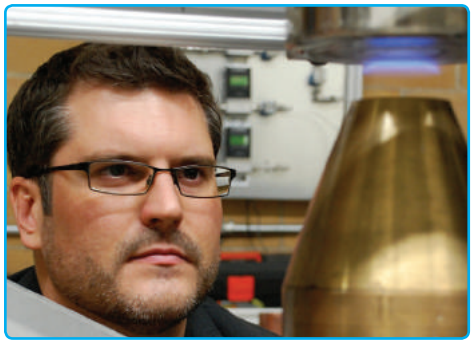
At room temperature, these alloys have two phenomena related to shear stress: slow moving of perfect dislocations to enhance material strength, and fast moving partial dislocations to enhance its ductility.



They also saw formation of three-dimensional stacking fault defects which is a barrier to dislocation movement and serves at enhancing material hardness. Accordingly, CrMnFeCoNi alloys will replace many alloys and will be used widely in Shipbuilding industry.

Can Metal Powder Replace Fossil Fuels?

"Technologies to generate clean electricity – primarily solar and wind power – are being developed rapidly, but we can't use that electricity for many of the things that oil and gas are used for today, such as transportation and global energy trade," said Professor Jeffrey Bergthorson. A Mechanical Engineering Professor and Associate Director of the Trottier Institute for Sustainability in Engineering and Design at McGill University.



The powder metals, proposed by professor Bergthorson and are used at zero-carbon heat engines, can produce heat close to fossil fuels used in internal combustion engines without CO_2 emissions that escape to the atmosphere. When they react with air, they form stable and non-toxic solid particles that can be collected relatively easy for recycling.

"Biofuels can be part of the solution, but won't be able to satisfy all the demands; as hydrogen requires big, heavy, and expensive fuel tanks. Batteries are too bulky and don't store enough energy for many applications." stated Bergthorson. "Using metal powders as recyclable fuels that store clean primary energy for later use is a very promising alternative solution."

The Foundation of The Biggest Steel Powder Plant

The Metalvalue SAS company and ASCO industries company have decided to create the biggest steel powder company in the world, together.

They intend to make gas-atomized steel powder to be used for existing process already on the market. It will be also used for Metalvalue's MMS_Scanpac process, which is a process developed by METEC Technologies AB to produce fully dense components from high purity gas atomized powders.

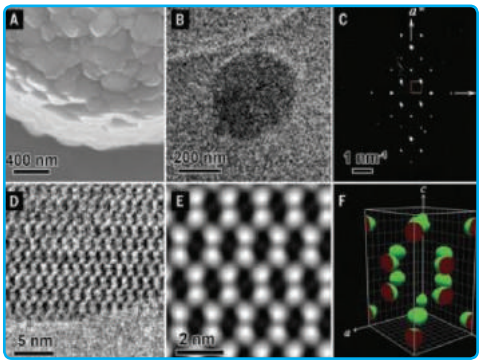
The two companies claimed that this plant will be the biggest in the world and will give France a leading position.

Weave A Material at The Nanoscale for The First Time

For the first time, it has been possible to weave a material at the molecular level. Weaving is a well-known way of making fabric and scientists have been able now to weave organic threads into a crystalline covalent organic framework like copper. It is named COF-505 and has high elasticity.

'It almost looks like a molecular version of the Vikings chain-armor. The material is very flexible.'says Peter Oleynikov, researcher at the Department of Materials and Environmental Chemistry at Stockholm University.

This material can be used to adsorb and store enormous quantities of molecules. A potential application is capture and storage of carbon dioxide, or using it as a catalyst to make useful molecules from carbon dioxide.



Constructing The World's Largest Vacuum Furnace

Western Pennsylvania Solar Atmospheres company announces that the construction of the new plant with the largest vacuum furnace in the world is in the implementation phase.

The building will be 18,000 square feet by the end of February and will be able to accept the massive chambers from Youngberg industries of Belvidere and the warehouse is filling up fast with all the major components by Solar Manufacturing Company.

According to Bob Hill, President of Solar Atmospheres of Western PA, the plant will be the biggest supplier for needs of aerospace and nuclear markets around the world.

A New Material Sensitive Than Human Skin

A new material has been developed by researchers at Monash University that was found to be more sensitive than human skin.

The new material is made from graphene and has high response to touch, in addition to its flexibility, durability, ultra-light properties, sponge shape, and the ability to sense pressure and temperature.

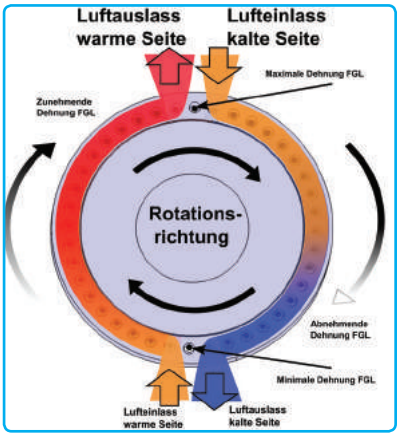
"It far exceeds the response range of our skin and also has a very fast response time, much faster than conventional polymer elastomer." said Dr. Ling Qiu of the Monash Centre for Atomically Thin Materials, or MCATM. The discovery of this material could be used in developing highly-advanced prosthetic limbs, as well as other flexible electronics.

Refrigerators Of The Future

Material engineering is still providing us with more efficient and environment-friendly solutions for Freon used in refrigerators. One of the promising techniques is the usage of shape memory alloys developed by engineers at Saarland University, Germany.

This alloy is a nickel-titanium alloy based on shape memory phenomena, in which the material becomes hotter when exposed to a strain or pulled tension and also becomes cooler when it relaxes after temperature equalization with the environment; It can undergo a sufficient cooling about 20 centigrade degrees below ambient temperature.

"The basic idea was to remove heat from a space – like the interior of a refrigerator – by allowing a pre-stressed, super-elastic shape memory material to relax and thus cool significantly. The heat taken up in this process is then released externally to the surroundings. The SMA is then re-stressed in the



surroundings, thereby raising its temperature, before the cycle begins again." stated Stefan Seelecke, Professor for Intelligent Material Systems at Saarland University.

After research foundation about 950,000 euros, these materials are expected to be used in practice very soon.

Making Guitar Parts Using Injection Molding

Liquidmetal Technologies Inc. and Martin Guitar have reportedly joined forces to make guitar parts using Liquidmetal amorphous alloys and manufactured by injection molding process (is a manufacturing process in which products are produced from materials fed into a mold cavity using different techniques).

"Liquidmetal has been associated with leading, world-class companies in various markets, including consumer electronics and watches," says Tom Steipp, CEO of LQMT. "Martin Guitar has a century long history distinguished by its contributions to and innovations in stringed acoustical instruments. We are pleased to collaborate with the Martin Guitar team."

The two companies aim to use material properties and manufacturing methods to produce guitar and similar instruments more easily and in an innovative manner.

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