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Recycling of Non-Ferrous Metals

Mr. P R Chandna
Member, IIM Delhi Chapter

General

The most commonly used non-ferrous metals are aluminium, copper, lead, zinc, nickel, titanium, cobalt, chromium and precious metals. Millions of tonnes of nonferrous scrap are recovered annually and used by smelters, refiners, ingot makers, foundries, and other manufacturers. Secondary materials are essential to the industry's survival because even new metals often require the combined use of recycled materials.

New metals made using recycled material			
Aluminium	> 33%	**Copper**	> 40%
Lead	> 35%	**Zinc**	> 30%

Aluminium, which is the most abundant metal in the earth's crust, is not surprisingly one of the most recycled materials today after steel and paper. It is also the only packaging material that completely covers the cost of its own collection and processing at recycling centres. Recovering aluminium for recycling is not only economically viable, but energy efficient and ecologically sound.

Due to the limited availability of these metals, the unrestricted flow of non-ferrous scrap from country to country according to industrial and consumer demand is crucial. BIR has consistently campaigned for the free movement of secondary raw materials to avoid shortages in certain geographical areas and surpluses in others. Import barriers could limit the supply to the manufacturing industry in some countries.

Recycling Processes

The metal recycling industry has an efficient structure with numerous small companies purchasing scrap material and feeding this to highly effective larger international businesses.

Non-ferrous metal recycling involves some, or all of the following steps:

Sorting: In order to be recycled appropriately, different types of non-ferrous metals need to be separated from each other as well as from other recyclables such as paper and plastic.
Baling: Non-ferrous materials are compacted into large blocks to facilitate handling and transportation.
Shearing: Hydraulic machinery capable of exerting enormous pressure is used to cut metals into manageable sizes.
Media separation: Shredders incorporate rotating magnetic drums to separate non-ferrous from ferrous metals. Further separation is achieved using electrical currents, high-pressure air flow and liquid floating systems. Further processing may be needed.
Melting: The recovered materials are melted down in a furnace, poured into casters and shaped into ingots. These ingots are either used in the foundry industry or they can be transformed into flat sheets and other wrought products such as tubing, which are then used to manufacture new products.

Applications

All metals can be recycled with minimal or no loss of their original physical properties. They are such versatile materials that the possible applications for each metal and their combinations are endless.

Aluminium

Aluminium has great recycling potential and is often re-used for the same application for which it was originally manufactured. Its strength, flexibility and light weight make it ideal for:

Building & construction: Window frames, building structures, roofs, etc.

Transportation: Aeroplanes, trains, boats, cars and trucks. It is also used in smaller vehicles like bicycles, motorbikes and other mobility devices such as wheelchairs.
Packaging: Aluminium is used mostly in the form of cans and foils.
Electricity: Since 1945, aluminium has replaced copper in high-voltage transmission lines.
Cooking and tableware.

Copper

After silver, copper has the best electrical conductivity of all the elements. It is also very good thermal conductor and is readily alloyed with other metals such as lead, tin and zinc for foundry applications to produce, among other goods, products for the transmission of water such as valves. Other common applications for recovered copper include:

Electrical applications: Wires, circuits, switches and electromagnets.
Piping: Plumbing fittings and also in refrigeration, air conditioning and water supply systems.
Roofing and insulation.
Household items: cookware, doorknobs, and cutlery.

Lead

Most of recycled lead is used in batteries, but there are many other applications for this metal:

Car batteries: Lead is still used extensively in the plates that work as electrodes.
Colouring: Although less common today, it is used in ceramic and glass glazing.
Radiation protection: Lead offers protection against X-rays.

Zinc

Zinc is present in everyday life in the form of coins. However, it also has other important uses:

Galvanisation: Zinc is commonly applied as a coating to protect iron and steel from corrosion in a process known as galvanisation.
Batteries: As an anode component material in batteries.
Brass: Created by alloying zinc and copper.

Tin

Apart from precious metals, tin is one of the most expensive non-ferrous metals. Hence, recycling from secondary materials is very important. Its applications are very varied:

Cans: by covering steel sheet with a thin layer of tin one obtains tinplate, the raw material to make cans
Car production: tin increases the resistance of the motor block, piston rings and clutch plates;
Springs of any kind become tougher through the addition of tin
Glass: tin oxide coatings of glass surfaces to make them more resistant

Recycling Facts

Almost 40% of the world's demand for copper is met using recycled material.
At present, approximately 30% of global zinc production comes from secondary zinc.
Over 80% of the zinc available for recycling is eventually recycled.

Aluminium

Of an estimated total of 700 million tonnes of aluminium produced since commercial manufacturing began in the 1880s, about 75% of this is still being used as secondary raw material today.
One tonne of recycled aluminium saves up to 8 tonnes of bauxite, 14,000 kWh of energy, 40 barrels (6,300 litres) of oil, 238 million Btu's of energy and 7.6 cubic metres of landfill.
The energy saved by recycling one tonne of aluminium is more than enough to power a US household for a whole year (The average US household uses about 10,000 kWh year).
Recycling aluminium uses 95% less energy than producing aluminium using raw materials.

Recycling one aluminium can save enough energy to power a 100-watt bulb for almost four hours.
A used aluminium can is recycled and back on the grocery shelf in as little as 60 days.
For every single can manufactured using virgin ore, the same amount of energy used will produce 20 recycled cans.
The aluminium drink can is the world's most recycled container - more than 63% of all cans are recycled worldwide.

COPPER

Copper's recycling value is so high that premium-grade scrap holds at least 95% of the value of the primary metal from newly mined ore.
Recycling copper saves up to 85% of the energy used in primary production.
In order to extract copper from copper ore, the energy required is approximately 95 million Btu/tonne. Recycling copper uses much less energy, about 10 million Btu/tonne.
By using copper scrap, we reduce CO2 emissions by 65%

ZINC

The average car contains up to 10 kg of zinc in its galvanized body panels. When they are discarded, these panels can be readily made into new parts of identical quality.

Total recovery of zinc within the non-ferrous metals industry amounts to 2.9 million tonnes, of which 1.5 million are new scrap or process residues and 1.4 million are old scrap.

Secondary zinc production uses 76% less energy than primary.

Nearly 70% of zinc from end-of-life products is recycled. Old zinc scrap consists primarily of die cast parts, brass objects, end-of-life vehicles, household appliances, old air conditioning ducts, obsolete highway barriers, and street lighting.

LEAD

50% of the lead produced and used each year throughout the world has been used before in other products. Today, about 80% of lead is used in acid batteries, all of which is recoverable and recyclable. Some countries boast a 100% recycling rate and most are capable of the same result using secondary lead instead of ore reducing CO_2 emissions by 99%

TIN

Global tin production amounts to 350,000 tonnes of which 50,000 tonnes is produced from scrap and other secondary sources. Primary production of tin requires 99% more energy than secondary production

Source: Bureau of International Recycling

Stainless Steel – The Surging Demand Scenario in India

S C Suri
Life Fellow IIM, Vice Chairman IIM-DC

The demand for stainless steel in India (the fourth largest producer and third largest consumer of this variety) is likely to grow at a compounded annual growth rate (CAGR) of 15 to 17% over the next three to four years. More and more consumers are likely to shift to consumption of stainless steel. The surge in demand is also likely to come as domestic steel makers adopt strategic steps to move up the value chain, thereby providing opportunities for the stainless steel segment to have a truly promising future.

India's per capita stainless steel consumption is a little more than 1 kg at present, which provides immense scope for growth. Considering the fact that global average per capita stainless steel consumption is 4 kg. Per capita consumption is expected to rise to over 2 kg in next 2-3 years.

These factors have prompted the leading domestic stainless steel makers such as Jindal Stainless Steel (JSL), Steel Authority of India Ltd (SAIL), Salem and Alloy Steels Plant to chart out capacity expansion plans that are likely to be on stream over the next few years.

The coming up of new facilities essentially will increase India's stainless steel melting /production capacity by around 30% to 3.80 Mtpa in the coming years from the existing capacity of 2.90 Mtpa at the end of 2010-11. The production capacity is expected to touch 3.3 Mtpa in 2011-12 itself, with the coming of new capacity of JSL in Orissa. In fact, JSL is planning to increase its capacity at Hisar to 1.00 Mtpa from 0.72 Mtpa, which it later plans to increase to 1.2 to 1.4 Mtpa. Its Orissa plant will have capacity of 0.8 Mtpa which is later on being planned to be doubled to 1.6 Mtpa.

The country's finished stainless steel production in 2010-11 was estimated at 2.6 Mt of 200 series (nickel content of 0.2 to 0.8%), 300 and 400 series, out of which 73% comprised flats and 27% comprised longs. The total demand was estimated at 2.4 Mt.

The country also imports flat and long stainless steel products to the tune of about 2-3 lakhs tonnes and exports about 4 lakhs tonnes every year.

Kitchenware and related products use about 70% of total corrosion free metal available in India while architecture, malls and multiplexes, airports, etc. consumes about 2%. Automotive sector and Railway constitute about 2%, while the remaining portion is shared by miscellaneous sectors including furniture etc.

Around 60% of the flat production is dominated by cold rolled stainless steel sheets, mainly used for the production of utensils. This is unique to India as it is the only country in the world to use cold-rolled sheets for making utensils, instead of coils. Also, around 65% of the demand in India is for kitchenware, mostly dominated by the smaller and fragmented players.

Future Demand Drivers

With stainless steel usage gaining ground in newer segments such as Railways, architectural buildings and construction projects, including airports, industrial segments and automotive white goods, prospects of consumption growth in India for this segment is better than ever.

Rising Uses in Railways and Transportation

Currently setting up of two factories each in Palghat and Rai Bareilly, Indian Railways is in process of manufacturing 15,000 new wagons made only of stainless steel. The Rai Bareilly facility was expected to begin production in 2011 and make 1,200 units in the first year. The Palghat unit, where production is expected to start by 2012, will make 600 coaches in the first year.

The Railways are expected to need over 70,000 tonnes of stainless steel this fiscal for building coaches and wagons, where per tonne cost of high grade material could be in the range of Rs. 95,000. The Railways plan to make about 10,000 -15,000 wagons, besides 5,000 wagons that are slotted for refurbishment – where the flooring would remain and the shell to be replaced with stainless steel. In addition, 9,000 new wagons of various sizes are expected to roll out this year. The Integral Coach Factory at Chennai is already making 1,500 coaches for the Mumbai Vikas Corporation.

The Railways will require 7-8 tonnes of stainless steel for each wagon depending upon the wagon capacity. Additionally, the Railways has also proposed to replace carbon steel with stainless steel across all existing super-fast trains.

Metro rail is a growing sector which will continue to create higher demand in future. Thus, the consumption of stainless steel may increase phenomenally in the next two years for which the industry will have to work hard to meet the demand.

On account of the superior quality of corrosion resistance to withstand the harsh tropical climate in India, the Railways is considering 300 series (nickel containing) stainless steel for all exterior surfaces

replacing the old carbon steel ones. Being suitable, cost-effective and maintenance free steel for all internal structural members, stainless steel is also specified for a good amount of furnishing inside the coaches. Even Railway stations are all set to get a facelift after doing a new and steely look with gleaming stainless steel chairs in the waiting room areas.

Railways is implementing to manufacture 7000-8000 coal wagons. The demand for steel is likely to grow. In the year to come, this consumption quantity is likely to multiply as Indian Railways is considering stainless steel options for transporting ores, minerals, fertilisers, food grains, limestone, fly ash, cement, oil tankers and others.

In conclusion it can be stated that the demand for stainless steel will grow at an annual rate of 15-17% and stainless steel producers have to create commensurate stainless steel production capacity.

My Memorable Moments in IIM

Mr. L. Pugazhenthy, Past President, IIM

Continuing from the earlier story in the last issue of this newsletter, my interaction with the industry icon and role model, Mr. Ratan Tata is evergreen and truly a long–lasting impression. It was on 13 Nov 2008 when Mr.Ratan Tata came to the NMD & ATM venue Greater India Expo Centre, Greater Noida to receive the first IIM-JRD Tata Award for Excellence in Corporate Leadership in Metallurgical Industry. Only a few months ago, the IIM National Council approved this award, eligibility criteria etc., Considering that the award is in memory of another great legend of the century, the first award, setting the benchmark, was an important one. Accordingly the IIM Awards Committee considered the names of India's topmost corporate leaders in the Indian Metals Industry and chose Mr.Ratan Tata for this prestigious award unianimously. Those days, Tata Steel had virtually become a household name in India after acquiring Corus; the Tata group had also acquired other well-known overseas brands in tea, hotels, automobiles etc.,

When Mr.Ratan Tata arrived at the venue at Greater Noida in the evening, there was a musical band at the entrance to welcome him and he thoroughly enjoyed. Getting down from the car, he introduced Mr.R.K.Krishna Kumar (Vice Chairman of the Tata Group of Hotels) and other colleagues escorting him. Before going to the stage, he went round the exhibition and was so impressed in seeing such a large scale metals expo. He went to the IIM stall and took a photograph with IIM Past Presidents, IIM Delhi Chapter office bearers etc.,

That evening I had the honour of welcoming Mr.Ratan Tata and saying many good things about the Tata Group and the Distinguished Guest. Addressing the gathering, he expressed his delight in being able to join the IIM conference once again (he said he had graced so many in the past) and particularly to receive an outstanding award, instituted to honour J.R.D.Tata. He spoke eloquently on Corporate Social Responsibility, the core value of the Tata Group. Shri Santosh K.Bargrodia, the then

Union Minister for Coal presented the award while Mr.J.C.Marwah, Secy Genl, IIM read the recitation. As soon as he finished and came down, he reached the wheelchair of Dr.Amit Chatterjee to make some personal enquiries. Around those days, the Nano- Singur controversy was raging all over and the media which was in such a large number at the venue pushing everybody so as to reach Mr.Ratan Tata, for an interview. Mr.Ratan Tata said that he has to reach Mumbai that night and had to rush to the airport. Mr.Tata wanted to avoid the media and rush to the car which was facilitated by the plain clothes security accompanying him. The audience, which enjoyed hearing a great personality, dispersed for a sumptuous dinner.

Technical Talk by Mr. Y S Kapadia formerly at Tata Steel & Lurgi India

A Technical talk was held on 20th August 2011 at IIM Delhi Chapter. The title of Mr. Kapadia's talk was "Steel Products and Processes Show-Cased at METEC 2011 Conference / Exhibition in Germany.

Mr. Kapadia in his presentation covered the status of various Iron and Steel making technologies. He also reviewed the developments in recent years in the Iron and Steel making area.

In this context, he made specific mention of the following:

1 Blast Furnaces are operating at near theoretical coke rates
2 Several new developments including automation measures in the LD steel making area for improvements in productivity and product quality
3 In the casting area the developments covered casting of thin slabs and strips.
4 In the area of electric arc furnace steel making the talk covered developments in productivity, energy recovery systems and secondary metallurgy for production of quality steel products.
5 Various futuristic technologies in the Iron, Steel and Energy area for improvement in product quality were also reviewed.

There were lively discussions in the question-answer session after the conclusion of the technical presentation.

School Students Interactive Meet & Elocution Contest

The IIM Delhi Chapter organized the School Students Interactive Meet & Elocution Contest on 27th August 2011. Around 60 students from six schools participated in the interactive meet. Students were accompanied by their Principals / Senior Teachers.

Shri Anil Gupta, Chairman IIM Delhi Chapter welcomed the participants. It was followed by a brief talk by Shri Raj Tiwari, Convener, Relations and Development Cell of IIM DC. The theme of his talk was the IIM & Students focus. Shri L. Pugazhenthy, Past President, IIM apprised students about Indian Metal Industry and the emerging Career Opportunities in the metallurgical segment. The inaugural address by the Guest of Honour was delivered by Shri V R Sharma, Dy. Managing Director & CEO – Steel Business, Jindal Steel & Power Ltd. Shri Sharma address motivated the young students and was greatly appreciated. In the Students Session, there was an elocution contest on the subject titled "Metals and Metallurgy – My

Perspective". The presentations by the students were highly informative and covered in great details the students perspective on metals and materials. A jury consisting of Shri S C Suri, Shri B R Thukral and Shri D. Kashiva evaluated the presentations made by the students. Master Varun of Mount Carmel School was awarded the first prize and Ms. Namya Bajaj of Manav Sthali School and Ms. Garima Sehgan of Bal Bharti Public School were awarded the second prize. The award winners were given mementoes and small cash prizes. All participants were given participation certificates.

The meeting was followed by lunch for all the participants.

METALS AND THE HUMAN BODY

Some debate exists as to what exactly constitutes a "heavy metal" and which elements should properly be classified as such. Some authors have based the definition on atomic weight, others point to those metals with a specific gravity of greater than 4.0, or greater than 5.0. The actinides may or may not be included. Most recently, the term "heavy metal" has been used as a general term for those metals and semimetals with potential human or environmental toxicity. This definition includes a broad section of the periodic table under the rubric of interest.

Regardless of how one chooses to define the category, heavy metal toxicity is an uncommon diagnosis. With the possible exceptions of acute iron toxicity from intentional or unintentional ingestion and suspected lead exposure, emergency physicians will rarely be alerted to the possibility of metal exposure. Yet, if unrecognized or inappropriately treated, heavy metal exposure can result in significant morbidity and mortality. This article provides a brief overview of general principles in the diagnosis and management of metal toxicity. The Table reviews the typical presentation of the most commonly encountered metals and their treatment in summary form. It is not intended to guide clinical decision-making in specific cases.

Many of the elements that can be considered heavy metals have no known benefit for human physiology. Lead, mercury, and cadmium are prime examples of such "toxic metals." Yet, other

metals are essential to human biochemical processes. For example, zinc is an important co-factor for several enzymatic reactions in the human body, vitamin B-12 has a cobalt atom at its core, and hemoglobin contains iron. Likewise, copper, manganese, selenium, chromium, and molybdenum are all trace elements, which are important in the human diet. Another subset of metals includes those used therapeutically in medicine; aluminum, bismuth, gold, gallium, lithium, and silver are all part of the medical armamentarium. Any of these elements may have pernicious effects if taken in quantity if the usual mechanisms of elimination are impaired.

The toxicity of heavy metals depends on a number of factors. Specific symptomatology varies according to the metal in question, the total dose absorbed and whether the exposure was acute or chronic. The age of the person can also influence toxicity. For example, young children are more susceptible to the effects of lead exposure because they absorb several times the percent ingested compared with adults and because their brains are more plastic and even brief exposures may influence developmental processes. The route of exposure is also important. Elemental mercury is relatively inert in the gastrointestinal tract and also poorly absorbed through intact skin, yet inhaled or injected elemental mercury may have disastrous effects.

Some elements may have very different toxic profiles depending on their chemical form. For example, barium sulfate is basically nontoxic, whereas barium salts are rapidly absorbed and cause profound, potentially fatal hypokalemia. The toxicity of radioactive metals like polonium, which was discovered by Marie Curie but only recently brought to public attention after the 2006 murder of Russian dissident Alexander Litvinenko, relates more to their ability to emit particles than to their ability to bind cell proteins.

Exposure to metals may occur through the diet, from medications, from the environment, or in the course of work or play. Where heavy metal toxicity is suspected, time taken to perform a thorough dietary, occupational, and recreational history is time well spent, since identification and removal of the source of exposure is frequently the only therapy required.

A full dietary and lifestyle history may reveal hidden sources of metal exposure. Metals may be contaminants in dietary supplements, or they may leech into food and drink stores in metal containers like lead decanters. Persons intentionally taking colloidal metals for their purported health benefits may ultimately develop toxicity. Metal toxicity may complicate some forms of drug abuse. Beer drinker's cardiomyopathy was diagnosed in alcoholics in Quebec, and later Minnesota, during a brief period in the 1970s when cobalt was added to beer on tap to stabilize the head. More recently, a parkinsonian syndrome among Latvian injection drug users of methcathinone has been linked to manganese toxicity.

Classic examples of environmental contamination include the Minimata Bay disaster and the current epidemic of arsenic poisoning in South East Asia. In the 1950s, industrial effluent was consistently dumped into Japan's Minimata Bay, and mercury bio-accumulated to exceedingly high concentrations in local fish. Although some adults did develop signs and symptoms of toxicity, the greatest impact was on the next generation, into which many were born with severe neurologic deficits.

Currently, millions of people living in and around Bangladesh are at risk for organ dysfunction and cancer from chronic arsenic poisoning from the water supply. In an effort to bypass ground water sources rife with bacterial contamination, tube wells were sunk throughout that area, deep into the water table. Bedrock rich in arsenic gives these deeper water stores—and the crops they irrigate—a high concentration of arsenic, and toxicity is epidemic throughout the area. Childhood lead poisoning linked to the ingestion of old paint chips in the North American setting is another good example of environmental contamination.

Metals have been used as instruments of murder. Arsenic is perhaps more rightly classified as a metalloid, but it is consistently the single substance most commonly thought of as a poison. Metals

have also been used in warfare as chemical weapons. Again, arsenic was the primary component of the spray known as Lewisite that was used by the British during trench warfare in World War I. Exposure produced severe edema of the eyelids, gastrointestinal irritation, and both central and peripheral neuropathies. The first antidote to heavy metal poisoning, and the basis for chelation therapy today, was British Anti-Lewisite (BAL, or dimercaprol), a large molecule with sulfhydryl groups that bind arsenic, as well as other metals, to form stable covalent bonds that can then be excreted by the body. BAL was developed by the Germans during World War II in anticipation of a reinitiating of gas warfare as had been waged earlier in the century.

In total, however, occupational exposure has probably accounted for the vast majority of heavy metal poisonings throughout human history. Hippocrates described abdominal colic in a man who extracted metals, and the pernicious effects of arsenic and mercury among smelters were known even to Theophrastus of Erebus (370-287 BC). The classic acute occupational heavy metal toxicity is metal fume fever (MFF), a self-limiting inhalation syndrome seen in workers exposed to metal oxide fumes. MFF, or "brass founder's ague," "zinc shakes," or "Monday morning fever" as it is variously known, is characterized by fever, headache, fatigue, dyspnea, cough, and a metallic taste occurring within 3-10 hours after exposure. The usual culprit is zinc oxide, but MFF may occur with magnesium, cobalt, and copper oxide fumes as well.

Chronic occupational exposure to metal dusts has also been linked to the development of pneumoconiosis, neuropathies, hepatorenal degeneration and a variety of cancers. These syndromes develop slowly over time and may be difficult to recognize clinically. In the United States, Occupational Safety and Health Administration (OSHA) regulations guide the surveillance of workers at risk and suggest exposure limits for metals of industrial importance.

Typical Presentation of the Most Commonly Encountered Metals and Their Treatment are given in the Table below:

Metal	Acute	Chronic	Toxic Concentration	Treatment
Arsenic	Nausea, vomiting, "rice-water" diarrhea, encephalopathy, MODS, LOQTS, painful neuropathy	Diabetes, hypopigmentation/ hyperkeratosis, cancer: lung, bladder, skin, encephalopathy	24-h urine: ≥50 µg/L urine, or 100 µg/g creatinine	BAL (acute, symptomatic) Succimer DMPS (Europe)
Bismuth	Renal failure; acute tubular necrosis	Diffuse myoclonic encephalopathy	No clear reference standard	*
Cadmium	Pneumonitis (oxide fumes)	Proteinuria, lung cancer, osteomalacia	Proteinuria and/or ≥15 µg/ g creatinine	*
Chromium	GI hemorrhage, hemolysis, acute renal failure (Cr^{6+} ingestion)	Pulmonary fibrosis, lung cancer (inhalation)	No clear reference standard	NAC (experimental)
Cobalt	Beer drinker's (dilated) cardiomyopathy	Pneumoconiosis (inhaled); goiter	Normal excretion: 0.1-1.2 µg/L (serum) 0.1-2.2 µg/L (urine)	NAC $CaNa_2$ EDTA

Copper	Blue vomitus, GI irritation/ hemorrhage, hemolysis, MODS (ingested); MFF (inhaled)	vineyard sprayer's lung (inhaled); Wilson disease (hepatic and basal ganglia degeneration)	Normal excretion: 25 µg/24 h (urine)	BAL D-Penicillamine Succimer
Iron	Vomiting, GI hemorrhage, cardiac depression, metabolic acidosis	Hepatic cirrhosis	Nontoxic: < 300 µg/dL Severe: >500 µg/dL	Deferoxamine
Lead	Nausea, vomiting, encephalopathy (headache, seizures, ataxia, obtundation)	Encephalopathy, anemia, abdominal pain, nephropathy, foot-drop/ wrist-drop	Pediatric: symptoms or [Pb] ≥45 µ/dL (blood); Adult: symptoms or [Pb] ≥70 µ/dL	BAL $CaNa_2$ EDTA Succimer
Manganese	MFF (inhaled)	Parkinson-like syndrome, respiratory, neuropsychiatric	No clear reference standard	*
Mercury	Elemental (inhaled): fever, vomiting, diarrhea, ALI; Inorganic salts (ingestion): caustic gastroenteritis	Nausea, metallic taste, gingivo-stomatitis, tremor, neurasthenia, nephrotic syndrome; hypersensitivity (Pink disease)	Background exposure "normal" limits: 10 µg/L (whole blood); 20 µg/L (24-h urine)	BAL Succimer DMPS (Europe)
Nickel	Dermatitis; nickel carbonyl: myocarditis, ALI, encephalopathy	Occupational (inhaled): pulmonary fibrosis, reduced sperm count, nasopharyngeal tumors	Excessive exposure: ≥8 µg/L (blood) Severe poisoning: ≥500 µg/L (8-h urine)	*
Selenium	Caustic burns, pneumonitis, hypotension	Brittle hair and nails, red skin, paresthesia, hemiplegia	Mild toxicity: [Se] >1mg/L (serum); Serious: >2 mg/L	*
Silver	Very high doses: hemorrhage, bone marrow suppression, pulmonary edema, hepatorenal necrosis	Argyria: blue-grey discoloration of skin, nails, mucosae	Asymptomatic workers have mean [Ag] of 11 µg/L (serum) and 2.6 µg/L (spot urine)	Selenium, vitamin E (experimental
Thallium	Early: Vomiting, diarrhea, painful neuropathy, coma, autonomic instability, MODS	Late findings: Alopecia, Mees lines, residual neurologic symptoms	Toxic: >3 µg/L (blood)	MDAC Prussian blue
Zinc	MFF (oxide fumes); vomiting, diarrhea, abdominal pain (ingestion)	Copper deficiency: anemia, neurologic degeneration, osteoporosis	Normal range: 0.6-1.1 mg/L (plasma) 10-14 mg/L (red cells)	*

*No accepted chelation regimen; contact a medical toxicologist regarding treatment plan.

MODS, multi-organ dysfunction syndrome; LOQTS, long QT syndrome; ALI, acute lung injury; ATN, acute tubular necrosis; ARF, acute renal failure; DMPS, 2,3-dimercapto-1-propane-sulfonic acid; $CaNa_2$ EDTA, edetate calcium disodium; MDAC, multi-dose activated charcoal; NAC, *N*-acetylcysteine.

(Text of presentation by
first Award Winner of Students Interactive Meet
- Master Varun, Mount Carmel School, New Delhi)

Ten Facts: You may like to know

1. Gold and copper were the first metals to be discovered by man, around 5000 BC, and together with silver these three elements are found in a metallic state in the earth's crust. Gold and copper are the only two non-white colored metals.
2. Did you know that the biggest pure-gold nugget was found in Australia in 1869 and weighed 156 pounds?
3. Did you know that gold is so soft and easily worked that you could roll an ounce of it into a hair-thin wire 50 miles long?
4. Gold helps save lives on the nation's roads. More than 30 million automobiles are equipped with air bag systems that have gold-coated electrical contacts to ensure that the system will work flawlessly for the life of the car.
5. There are about 10 million passenger cars made each year in the United States. Natural resources are used to make each of the 15,000 parts in each of those cars.
6. In the average 3,000-pound car there are 240 pounds of aluminum, 42 pounds of copper, 22 pounds of zinc, 250 pounds of plastics and 140 pounds of rubber.
7. Did you know jade because if its toughness has been used for many cultural things like hammers, fish hooks and stone axes?
8. Did you know that a quartz is one of the most common minerals on Earth?
9. Did you know that marble is formed from metamorphosed carbonate rock, most usually limestone?
10. Did you know that the Taj Mahal built between 1632 and 1654 in India is made entirely out of marble?

Contributed by Mr. P R Chandna, Member, IIM DC

National and International News

Steelmakers eye exports as domestic demand dips

Steelmakers are exploring the world market following a dip in domestic demand. According to the Joint Plant Committee (JPC) data, steel exports in the first quarter ended June 30 jumped 71.8 per cent at 1.074 million tonnes against a mere 0.62 million tonnes during the same period last year. Rising output, however, managed to curtail imports, which fell by 52 per cent in the period under consideration i.e. quarter ending June 2011. However, India still remains the net importer at 1.32 million tonnes at the end of the first quarter.

Essar to invest $750 mn in Zimbabwe steel unit

Essar Africa Holdings Ltd will invest $750 million to restart production at steel firm Zisco in Zimbabwe. The company said the deal has been concluded and the company will now be called NewZim Steel Private Ltd. The mining company will be called New Zim Minerals Private Ltd.

Source: Business Standard, 4th August 2011

TATA steel MD update on steel project status in India

All major investments as envisaged in the current financial year will be made in TATA Steel's Jamshedpur plant. The rest of the other Greenfield projects are not making any significant progress. The Jamshedpur plant is expanding its capacity by 3 million tonnes at a cost of INR 20,000 crore. After the completion of the expansion by March 2012, the total capacity would increase to 10 million tonnes. TATA Steel is investing INR 8,000 crore in the current financial year, which will be in the Jamshedpur plant. Speaking about the other Greenfield plants, MD Tata Steel said the Orissa project was progressing satisfactorily, but other projects in Jharkhand, Karnataka, Chattisgharh and Vietnam have not made much progress.

Source: Steelguru

Rio Tinto signs MoU with JSPL to relocate Kwinana HIsmelt plant to Angul

Rio Tinto has signed an MoU with Jindal Steel and Power Limited to take the next step in global commercialization of the HIsmelt technology to be used in a fully integrated steel making facility. The MoU will also involve the relocation of the existing Kwinana HIsmelt plant from Australia to India at JSPL's existing facility in Angul, Orissa. The relocated plant will be fully owned by JSPL. JSPL and Rio Tinto will work together to further develop and market the technology. HIsmelt, (High Intensity Smelting) is the world's first commercial direct smelting process for making iron straight from the ore. The technology smelts iron ore fines directly using non coking coals, and offers significant economic and environmental benefits to the steel industry.

Source: Steelguru

Recession reports - No major impact of US crisis on Indian economy

Ruling out any major impact of the ongoing crisis in the West on India's GDP growth, former RBI governor Yaga Venugopal Reddy has said the impasse is very fluid and it is too early to assess its effect on the domestic economy. Mr Y. V Reddy credited for firmly anchoring the domestic financial system and economy during the pre-crisis boom that helped the country tide over the 2008 disaster earlier than expected. He said that "Though there will be some spillover effect on our economy, it won't be that grave as our growth is primarily driven by domestic consumption." Ruling out a recession in the short term, he said that a slowdown in global economic growth was certain in the mid to medium term. Mr Reddy told that "While the 2008 crisis was a revelation for everyone, the present crisis arising from the US downgrade by S&P and the lingering debt crisis in the Eurozone economies, is a realization of the fact that the fundamental problems are still not rectified." However, he cautioned that it was too early to assess the development as the situation was too fluid. Projecting an economic expansion of around eight per cent for the domestic economy, with a downward bias, he said to achieve that growth rate, our policy focus has to be fine-tuned at the earliest. Whether there would be a flight of capital if the US economy slips into another recession in the wake of the last week's credit downgrade-from AAA to AA+, Mr Reddy said that "If there is excess liquidity in the US system, then we have a fair chance of getting more capital inflows. But if a serious slowdown kicks in, there could be volatility in the fund inflows." He added that "This is more so because the global situation is more complex and fluid today than it was in 2008. Moreover, the inherent strength of the economy is not as strong as it was three years ago when the fall of Lehman Brothers yanked down the global economy into one of the worst recessions. Therefore, the key monetary focus should be domestic economy."

Source: Steel Guru

Latest Supply/Demand Roundup of Hot Rolled Plates

In West Europe, the divergence between demand in the commodity plate market and that for the higher specifications continues to grow. Despite relatively low stock levels of standard quality grades, buyers are staying out of the market as they anticipate further price reductions. Conversely, producers of the more exotic material are noting increased order volumes for deliveries in the third quarter. Consumption is solid from offshore applications and yellow goods manufacturers. MEPS

estimates the output of plate will be up, this year, by 10 per cent on the outturn in 2010. In Japan, sales of plate to the construction industry continue to be weak. However, shipbuilding demand remains buoyant. Plate output is predicted to reach 14 million tonnes this year. Activity at the South Korean shipyards is strong. Mills could lift production by more than 20 per cent, year-on-year, due to newly installed capacity. It is anticipated that output in China could expand to over 75 million tonnes in 2011 - a year-on-year rise of almost 10 per cent. Further but more modest gains are anticipated in 2012. An additional 100,000 tonnes of plate could be produced by Taiwanese mills this year. We believe this may lessen the need to purchase third country material. Consumption by the building industry has been firm but is now slow for seasonal reasons. US demand for the higher specifications, for project work, is strong. Shipments of hot rolled plate are projected to expand by 8.7 percent in 2011. Consumption of commodity material has slowed in Canada. Mill business for the more exotic grades is better. There has been little in the way of new import offers but foreign material, ordered earlier in the year, is now hitting the market. Mill supply is forecast to grow by 7.4 per cent in 2011.

Source: Meps Steel News

India ranked 6th globally in Materials Science Research

From the Mehrauli Iron Pillar near the Qutub Minar in Delhi to the foundries of Bastar, where the tribals sculpted figures from smelted iron and brass hundreds of years ago, metallurgy and materials sciences has had a long tradition in India. Perhaps in keeping with this, the finding by Thomson Reuters states that India occupies the sixth position in terms of research output in material sciences, and is one of the leading countries in the Asia Pacific region, comes as an encouraging development. According to the Thomson Reuters Global Research report: Materials Science and Technology, China leads with 55, 003 scientific papers followed by the US (38,189); Japan (25,473), Germany (16,832); South Korea (15,261) and India (12,693). Materials science and technology is a core area of research for many economies due to its potential contributions to manufacturing processes and innovative products, and Asia, including India, is leading in this area of research, the report released recently said. The use and development of materials has constituted a major content in the history of mankind. The history of technology is replete with important examples of revolutionary change brought on by the discovery of new materials and new uses for materials. Bronze gave way to Iron, then to Steel and arguably now to Silicon. Will cars be fuelled by hydrogen stored in metal-organic frameworks (MOFs)? Will stem cells grown on nano-fibrous scaffolds make organ replacement routine? The fact that we can pose these questions says something about recent advances in materials science and technology, the study says. MOFs are porous crystalline solids which can be shaped to store gases like hydrogen, methane etc. Their potential for energy storage has generated lots of excitement among scientists.

Congratulations to Mr. D. Kashiva

Mr. D. Kashiva, a Life Member of The Indian Institute of Metals and former Joint Indl. Advisor, Ministry of Steel has taken over as Director of Sponge Iron Manufacturers Assn. Congratulations!

Source: The Hindu

IIT ranked 20th

Interestingly, the Indian Institutes of Technology slammed by Union Minister of Rural Development Jairam Ramesh (himself an IITian), as doing hardly any worthwhile research, is placed 20th worldwide in terms of institutions ranked by citations in materials science research. These findings are based on a study of over 11,500 journals and tracking of the growth of materials science research outputs — substantive articles and reviews over the three decades from 1981. Materials science now accounts for nearly 60,000 articles and reviews per year, representing about 5 per cent of all such papers in the sciences indexed in web of science. By comparison, Chemistry represents 11.5 per cent, engineering and physics 9 per cent each. The interesting areas of materials that are growing are around the nano-science front, which serves as the bridging area between physics and chemistry. Other major

research fronts close to materials are solar cells, fuel cells and polymerization, the study report said.

Source: The Hindu

Asia to fore, US lags

Who will be in the vanguard of this change? Asian nations and institutions are clearly focusing their research efforts on new materials. There does not appear to be a similar commitment to this research on the part of Europe and North America — especially on the part of the US which has seen its world share of materials sciences research papers not only fall by half in the last three decades but actually decline in output in the late 1990s and in the early years of the last decade.

Source: The Hindu – Business Line

Iron ore mining clamp hits foundry sector

The closure of mines in Karnataka's Bellary-Hospet region has started hitting the downstream sector. Around 5,000 foundry units and a similar number in the sponge and pig iron sector have been facing a big shortage of iron ore supply. The foundry sector makes key equipment for the auto and engineering industries. Downstream sectors such as foundries are, therefore, facing a big shortage of supply of quality pig iron, the key raw material for all major auto and engineering grade foundries. The frequent rise in interest rates by banks is another problem for the foundry sector. "Steel and other metallurgical industries are severely affected," said A K Anand, director of The Institute of Indian Foundrymen (IIF). Bellary-Hospet is known for high-grade iron ore, not available in abundance elsewhere in the country. Karnataka produces nearly 30 per cent of India's yearly output of 220 million tonnes of iron ore.

Task Force on Membership Development

The Council of The Indian Institute of Metals has constituted a **Task Force on Membership Development** under the Convenorship of Mr. L. Pugazhenthy, Past President IIM (2008-09). The task force will give suggestions and recommendations on membership development, benefits, directory of members, corporate membership, enrolling students and women etc., other members of the task force are Dr. Indranil Manna, Dr T. Venugopalan, Dr. U. Kamachi Mudali, Dr (Smt) Suman Mishra and Mr. M. C. Shaji. IIM Delhi Chapter members are invited to send their suggestions, views etc., on membership–related issues to Mr. L. Pugazhenthy (email id: ilzda.info@gmail.com) or to IIM DC office.

"Foundry units are facing problems from both sides — lower realisation and high cost of production due to a dramatic spurt in interest rates for their working capital," said C Nagarajan, a National Council member of IIF. Interest rates have risen by four per cent in the past six months and raw material prices by 15-20 per cent. According to an estimate, about 500 small and independent sponge iron units, largely in Chhattisgarh, Gujarat, Tamil Nadu and West Bengal, are facing a closure threat due to non-availability of ore. The shortage of ore has already started impacting steel and other downstream producers. Sponge iron prices first shot up to Rs 24 a kg when the mining ban in Bellary-Hospet was announced. It then cooled, to the current Rs 22 a kg. "The sponge iron industry is currently breaking even. Any rise in raw material prices from here will turn the returns negative," said Amitabh Mudgal, vice-president of Monnet Ispat, one of the largest producers. An estimated 32 million tonnes of good quality ore is annually required to meet the need of industry, of which 3.5-4 mt is for feeding the foundry industry for production of pig iron. Currently, iron ore mining in Bellary-Hospet is restricted to the public sector NMDC, whose capacity is inadequate to meet the foundry industry need, says Anand.

Source: Business Standard

Experts PEG FY12 Growth Below 8%

Many economists do not think the robust industrial growth in June can be sustained and doubt whether economic growth in this quarter (July-September) or in the entire on-going financial year

(2011-12) will go above eight per cent. The government and its top advisors say they expect the economy to grow in the range of 8-8.6 per cent in June against this financial year. Industrial growth rose to 8.8 per cent in June against 5.9 per cent in May, but most of it was accounted for by capital goods, data on which is considered volatile. YES Bank chief economist Subhada Rao pegged economic growth in the first quarter of this year at 7.6 per cent and for all of 2011-12 at 7.9 per cent. Industry constitutes just over 18 per cent of India's gross domestic product, while agriculture accounts for almost the same portion. The service sector accounts for the rest. Kotak Mahindra Bank's chief economist, Indranil Pan, said there seems to be a pattern that a rise in industrial growth numbers mostly occurs in the third month (June) of a financial year. This could mostly be due to the inventory stocking cycle. Growth in the next month is, thus, more likely to fall off once again as capital goods numbers emerge slower, he said. Capital goods growth surged 37.7 per cent in June from just 3.7 per cent a year before. Pan projected the overall economy to grow by 7.5 per cent in the first quarter and 7.3 per cent for all of 2011-12.

Sombre Cues

Outside the capital goods sector, industrial growth was just 3.8 per cent for June. It is a source of concern that basic and consumer goods continue to suffer, said Mr. Anis Chakravarty, Director, Deolitte, Haskins & Sells. It is too early to say whether this shows an overall cyclical turnaround. There are cues on the general weakening of the global economy and we have to wait and observe whether this trend persists. Consumer goods grew just 1.6 per cent in June against 13.3 per cent in the same month last year, pulled down by a high interest rate regime and the base effect. In the June quarter, industrial growth slowed to 6.8 per cent from 9.6 per cent in the same period last year. The growth was down sequentially as well, as it was 7.9 per cent in the previous quarter.

Source: Business Standard

SAIL to Set-up 4 Iron Ore Pellet Plants

SAIL will set-up four pellet plants over the next two to three years to utilize fines generated by its mines. The company would set up a 4 Mtpa pellet plant each in the Gua mine in Jharkhand and the Bolani mine in Orissa, a 1.5 Mtpa plant in the Dalli Rajhara mine in Bhilai and a 2 Mtpa pellet plant near the Bokaro Stel Plant. The use of pellets is aimed at increasing blast furnace productivity by 25% at its plants. Three of the four pellet plants would be set up at pitheads, thereby saving on the cost of transportation as well as on environmental issues. The fourth one would be close to Bokaro Steel Plant. The pellet plants would entail a total investment of Rs. 600 crore. The pellet plant in the Gua mine is in an advanced stage and will be operational by the end of this year or early next year. The pellet from these plants will replace about 7 to 8% of the total iron ore requirement of the blast furnace in SAIL's existing steel plants and about 15% at the upcoming plants of India Iron and Steel Company, Rourkela Steel Pant and Bhilai. The use of pellets would enhance the productivity of its blast furnaces to 2.25 tonnes cu.m per day. SAIL currently uses the sintering route for iron ore lumps

Source: Steel Tech, July 2011

Committee on "**Materials 2035**"

Following the VISION 2020 series, the Technology Information, Forecasting and Assessment Council (TIFAC), a body under the Dept of Science & Technology, has constituted a Committee on "**Materials 2035**", under the Convenorship of Mr.L.Pugazhenthy, Past President, IIM; the committee will deliberate on aspects like future trends, related challenges, critical technologies, potential areas, drivers and impedances. IIM Members are most welcome to send inputs on Materials 2035 to Dr.Gautam Goswami, TIFAC (email id: goswamig@hotmail.com)