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The Crucible

REACH & The Artist's Palette

Metals In The Body: Titanium

Welcome from the Editor

Welcome to the latest edition of the Crucible. We are now entering the final period of what has been a very busy year for the MMTA. I would very much like to thank all the Members who have offered input and helped us with our current projects, as well as our planning for 2015. We hope to get the opportunity to see many of you at one of our end-of-year events in New York and London, or at our conference in April. As this is the last Crucible of 2014, I would like to take this opportunity to wish you and your families a festive end to the year and our very best wishes for 2015.

Maria Cox, MMTA

TAKING PLACE AT THE FAIRMONT ROYAL YORK HOTEL, TORONTO,

FROM 27—29 APRIL 2015

Be sure to take advantage of the current MMTA Members' Early-Bird Rate which is available until 14th January. If you aren't yet an MMTA Member, don't delay in completing your application to ensure your Member discount.

We are also offering a competitive non-members' Early-Bird Rate.

Join over 100 delegates who have already registered for this event.

We will once again be hosting a high-quality speaker programme, including confirmed presentations from **Pratt & Whitney, Alcoa, IBM, First Solar, Indium Corp, 5N Plus & the Mining Association of Canada**, as well as excellent networking opportunities.

Themes include aerospace, batteries, solar applications electronics and more!

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JOHN SYKES, RIP

John Sykes, who died aged 75, was an accomplished sportsman and lawyer with considerable charm, who was a good friend to many members of the MMTA. He was Captain of Esher Rugby Club in 1966 and helped fellow rugby players with everything from driving infringements and marital problems to commercial disputes. He won several notable cases for Wogen in different jurisdictions including the USA, Japan and Holland in the '80s and '90s and later, and news of his achievements spread mainly on the golf course, so that other MMTA members signed him up.

In a Fathers' and Sons' Cricket match he once bowled out Prince Harry. The umpire, who was Prince Andrew, told John "Sorry, mate, there goes your Knighthood".

By Colin Williams, Wogen Resources Ltd

John Sykes was a member of the MMTA's Mediation & Arbitration Committee.

NOTIFICATION—MMTA METAL NORMS

It has been drawn to our attention that some Members did not see the notifications we sent out prior to implementing the changes to several of the MMTA Metal Norms which had been developed by the Metal Norms Working Group.

Some new norms have been added, some existing norms have been amended and some norms have been removed.

These changes were implemented in September and affect the following norms:

Ferro-Chrome	Antimony
Hafnium	Ferro-Silicon
Manganese	Tantalum
Molybdenum	Ferro-Titanium
Ferro-Molybdenum	Ferro-Vanadium
Niobium	Tungsten
Nickel-Niobium	Ferro-Tungsten

PLEASE TAKE THE TIME TO ENSURE YOU ARE FAMILIAR WITH THE CHANGES & NOTIFY THE MMTA EXECUTIVE TEAM IF YOU STILL NEED ANY OF THE REMOVED NORMS

INSIDE THIS ISSUE

The MMTA promotes essential elements that add quality, safety and enjoyment to our lives.

The MMTA is the world's leading minor metals industry organisation.

mmta Minor Metals trade association

REACH & The Artist's Palette

REACH legislation is having an impact on many aspects of the minor metals world, but some may be unaware that the European Union's Chemical Agency (ECHA) is considering a request from Sweden to severely restrict or even ban the use of all cadmium pigments. When we think of pigments, we may think of all the industrial uses, but the art world is currently mounting a campaign to highlight the effect of potential restriction on the work of artists. "It could be a significant reduction to the artists' palette – arguably an even bigger change than the restrictions applied to the use of lead in artists' colours. Whereas the risks associated with lead were undeniable and obvious, the premise on which the cadmium proposal is based appears both unconvincing and entirely unnecessary to many in the industry," according to Michael Craine, Managing Director of Spectrum Artists' Paints and representative of the European artists' colours association (CEPE).

The environmental concern is to prevent such materials entering the water course and, as Michael Craine outlines, the fear is that by rinsing brushes in the sink, cadmium may enter the waste water treatment plants and end up in the sludge. When the sludge is spread on agricultural land, growing crops absorb the cadmium and consequently this will lead to an increased exposure to humans via food. It is important to differentiate that the cadmium pigments used in artists' colours are not classified as hazardous, on the basis of all the testing and data gathering required for REACH registration dossiers. Nevertheless, over the years, paint makers have used cadmium pigments of progressively lower solubility in efforts to further increase safety.

Artists are not amongst the world's big polluters, but "the artist fraternity has probably been caught with a punch intended for a much bigger boxer!", describes Michael Craine, "The greater risks associated with cadmium are in the industrial setting of the paint manufacturer, where inhalation of dry pigment could be possible if appropriate measures were not taken. As a consequence CEPE members set stringent workplace exposure limits and hygiene requirements. We take this seriously and workers exposed to cadmium pigments are required to have periodic testing to determine their blood levels of the element".

There are a number of initiatives regarding the long term environmental impact of cadmium in landfills and water courses. The landfill issue is largely the result of the use of soluble cadmium compounds in battery manufacture and the sheer numbers of spent batteries in the waste stream. However, for the purposes of reducing the potential for cadmium compounds leaching out of landfills, cadmium from all sources is of concern to the agencies regulating waste disposal. Any cadmium-containing waste that releases the metal is considered hazardous waste.

According to the International Cadmium Association (ICDA), "cadmium pigments and stabilisers are important additives in certain specialised plastics, glasses, ceramics and enamels to achieve bright colours along with long service lives, even in very demanding applications. From an ecological point of view, it is important to develop and maintain functional products with long service lives, once again to minimise the input into the world's waste stream. Inferior substitutes which produce shortened service lives will ultimately only increase the volume of the world's waste. It should also be emphasised that cadmium in these applications is in a chemically very stable, highly insoluble form, and embedded in the product's matrix".

CEPE fears that if the case against cadmium in artists' colours is accepted, it makes no recognition of the generally high standards demanded by artists and paint makers and leads the way to further bans of even safer pigments in the future. CEPE members also fear that should European manufacturers lose the right to use cadmium pigments, inferior products, with potentially lower environmental standards, will be imported and remain illegally in circulation.

"The worst-case scenario is that cadmiums could have disappeared within a couple of years, which in the view of many of us in the industry is both distressing and entirely unnecessary".

Cadmium pigments were discovered around 1820 and first used commercially for artists' use by the mid 1840's. The cost and scarcity of the metal kept their use relatively limited in mainstream artists' materials until the 1920's. Their introduction provided unequalled hues in the yellow to deep red range. Cadmium hues range from pale to golden deep yellows; light fiery to deep oranges through to light, bright scarlet to deep reds and maroons. These brilliant pigments are loved for their strength, purity and light fast properties. Some artists prefer more descriptive and perhaps more illustrative adjectives such as zingy, joyous and singing colours!

There are alternatives, but they are limited and generally poor relations. Although the properties of alternative organic pigments are in many ways similar to cadmium colours, they are not identical in every respect. Variations include how the colours mix to create new colours, their strength, opacity and purity, all of which are important qualities for the artist.

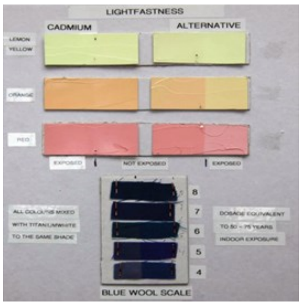
Craine argues that "the art world uses cadmiums of low solubility to make the small risk smaller still. They are sufficiently safe that we all make casserole in pots that are painted in cadmium orange and yellow! Even the EU itself admits that the paints we make using the pigments we select are not considered hazards under REACH. [There are those who would like] metals generally to be taken out of paints, however, if we were to do that, where would that leave the building blocks of painting: titanium and zinc white?"

The laboratory results (right top) illustrate the difference in quality between the cadmium colours and the alternatives, according to the work CEPE has undertaken.

Maria Cox, MMTA (adapted from an article by Spectrum Artists' Paints)

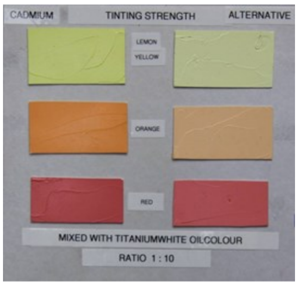
Laboratory Test Results on Cadmium Pigments

Lightfastness



Opacity

Tinting Strength



CRITICAL RAW MATERIALS ALLIANCE

The MMTA recently joined other members of the CRM Alliance at the European Parliament in Brussels on 14th October for the first official CRM Day. The objectives of the Alliance, which now has 15 members from across industry, were to review concerns, experienced by individual materials on the CRM list, and also concerns experienced across the group at the EU level. Alliance members reconfirmed their objective to ensure that CRMs receive a **systematic consideration when EU legislation is being drafted**, and that **EU funding should not be focused on substitution**, which all agreed takes place at a commercial level as a matter of course. In practice, this meant the **establishment of a clear strategy of the CRM Alliance to promote the importance of critical materials** (many of which are minor metals) **to the EU** and to support a CRM policy.

During a CRM Lunch at the European Parliament, members of the CRM Alliance had the opportunity to voice their concerns to representatives of the European Parliament and Commission with a responsibility for Raw Materials Strategy. The group also learned more about the methodology for defining the 2014 CRM list and other factors that may be taken into consideration when compiling the next list.

Following the CRM Day, the Alliance received notification from the European Commission that, due to its specific expertise, the Alliance will be granted a seat in the Ad Hoc Working Group on Raw Materials as observer. This means that the Alliance will be invited to attend technical discussions for each CRM within the Alliance during the process of revising the list of "Critical Raw Materials for the EU".

The CRM Alliance is now working hard to provide the information that industry and government need to understand CRM supply, and help level the playing field after about 30 years of lack of investment. Efficient and supportive government policy is very important to the development of the CRM businesses, as is industry being aware and realistic about the time and cost that is required to provide secure alternate supply.

Tamara Alliot, MMTA

CRM Alliance
Critical Raw Materials

To read the full event report, please see the Members' Area of the MMTA website.

MMTA OFFICE MEETING ROOM

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- Library and PC resources
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mmta
Minor Metals Trade Association

Click here to book the MMTA meeting room.

The History of Minor Metals in Artists' Paints

"Colour – along with light, shadow and movement – defines everything we see".

Until paint was produced commercially during the Industrial Revolution (circa 1800), painters had to make their own paints by grinding pigment into oil. The paint would harden and would have to be made fresh each day. Although paint appears smooth to the naked eye, on a microscopic level, particles of pigment are suspended in oil.

Cadmium pigments are not the only minor metals that have been used by artists over the centuries.

The Artists' Palette

Blues:

In spite of its high cost, medieval and Renaissance artists used ultramarine, a brilliant pure blue extracted from the semi-precious stone lapis lazuli, the only source of which was the Sar-e-Sang mines in modern-day Afghanistan.

Indigo – a dark inky blue – and also used from the earliest times, is extracted from plants, but fades due to light, as do many plant based pigments.

Smalt – a blue glass made by adding cobalt oxide to a potash rich molten glass, gave a pale colour but poor tinting strength, and lost its colour with time, becoming brown or greyish. It was a standard pigment in the 16th and 17th centuries because it was cheap and widely available.

A perfect new pigment for the Impressionists—chrome orange is contrasted with cobalt blue, its opposite in the colour spectrum

Pierre-Auguste Renoir, The Seine at Asnières (1875), The National Gallery London.

Prussian blue appeared at the start of the 18th century and marked a major change in the artist's palette. It is a synthetic pigment made in Berlin between 1704 and 1710. It has a dark intense colour similar to indigo and quickly became popular.

In 1802, another synthetic blue, **cobalt blue**, was invented, providing a stable and reliable pure, deep blue that was very popular with the Impressionists.

Cobalt blue is a cobalt oxide-aluminium oxide. Although very costly, it provided an extraordinary stable pigment of pure blue colour. It is now the most important of the cobalt pigments, having replaced smalt, which was by far inferior.

Vincent van Gogh declared to his brother Teo, 'Cobalt [blue] is a divine colour and there is nothing so beautiful for putting atmosphere around things..."

The below painting witnesses Renoir's shifts from cobalt blue to the new and cheaper artificial ultramarine.

Renoir, Pierre-Augustec. The Umbrellas (Les Parapluies)1881-85

This painting was painted during a period of restlessness in Renoir's work, and it can be seen that the picture exhibits two distinct styles. The group of figures on the right is painted in a soft feathery style reminiscent of his work of the later 1870s, while the umbrellas and the couple on the left are painted in a harder manner with more distinct outlines and subdued steely colours. The exact date of the painting is not known, but it is generally accepted that it was worked on over a period of several years.

The women in Renoir's paintings are usually dressed in the latest styles, and the dresses and hats worn by the figures on the right conform to a fashion that appeared in 1881 and which became popular in 1882. The vogue was superseded the following year by a more severe style of dress with simple straight lines. The woman at the front of the picture to the left is dressed in this latter style, which was fashionable in the 1885-6 season.

Examination of the cross-sections has shown that in the earlier phase Renoir used exclusively cobalt blue, available from 1802, and his habitual choice during the 1870's and early 1880's, but in finishing and revising the painting, he used only ultramarine, which came in use in the 1870s.

Egyptian Blue—a very stable synthetic pigment of varying blue colour, is a copper calcium silicate that was the first synthetic pigment and the most extensively used from the early dynasties in Egypt until the end of the Roman period in Europe. Many specimens, well over 3000 years old, appear to be little affected by the passage of time.

The New Life of Egyptian Blue

Egyptian blue could find use in the modern era in applications such as biomedical analysis, telecommunications, and lasers, according to a report from 2009. A study of the pigment's luminescent properties assesses its quantum efficiency and lifetime. It was found that Egyptian blue has an exceptionally high luminescence quantum yield for a molecular-level infrared emitter. These features make Egyptian Blue a promising candidate for use in bio-medical applications, for example, because infrared photons can deeply penetrate human tissue and the pigment's emission at 910 nm minimizes light absorption by tissues. Furthermore, the pigment is extremely stable, exhibiting bright luminescence even after millennia.

Ancient Egyptians may not have gained eternal life, but one of their most frequently used pigments may now have a future in a variety of high-tech applications.

Fowling in the marshes *, Nebamun wall painting fragment, British Museum, London, UK*

Top: visible.

Bottom: infrared photo-luminescence. Bright white areas in the photo-luminescence image correspond to the presence of high luminescent Egyptian blue.

Greens:

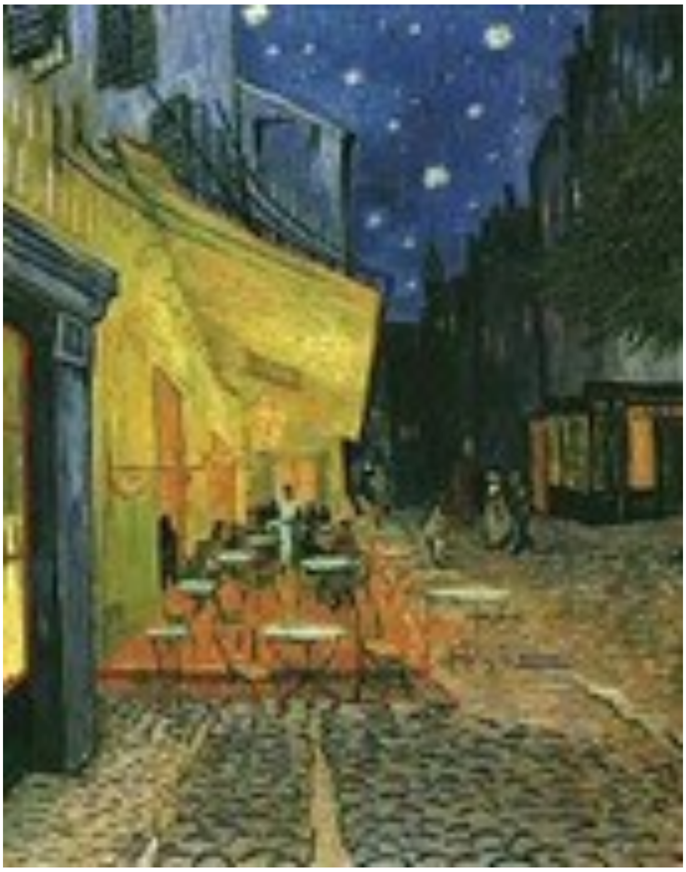
Essential for depicting landscapes, and used extensively in European art for depicting drapes and clothing, green has always been an important colour in European art. Although there were no stable, intense green pigments before the 19th century, this was not a huge problem, as green pigments can always be mixed from blue and yellow and adjusted with whites, blacks or browns etc. Malachite, a green mineral pigment, was used, but was insufficiently strong. Verdigris, a copper-based pigment used from the earliest times, has a powerful, intense colour, but can be unstable and vulnerable to light fading. In the 19th century, new green pigments such as **emerald green** (copper and arsenic) and **viridian** (chromium oxide) were used, with viridian being a favourite of Cezanne, Renoir and Monet.

Viridian is a very stable and powerful cold green. It is a chromium oxide di-hydrate. Guignet of Paris patented the process for manufacturing viridian (or transparent oxide of chromium) in 1859. Its excellent permanence and lack of toxicity could replace all other greens, both ancient and modern.

"Viridian analysis spots fake Van Gogh"

Studying paint compositions may give quite specific answers on ancient pigment production and adds to the armoury of forensic research. Analyses on more than 90 paintings from around the turn of the 20th century (Van Gogh, Kandinsky, Hodler, Klee) have revealed that the majority of samples with viridian contain a production by-product, a low water containing amorphous chromium oxide borate, which is absent in contemporary viridian. In contrast to modern samples of the post-war period, earlier viridian products are associated with this process-related by-product. This pigment information is used in combination with other data for the authentication and dating of paintings.

Vincent Van Gogh, Café Terrace at Night, 1888, Kröller-Müller Museum, Otterlo



Reds:

Another indispensable colour, in ancient times **vermilion** was ground from the mineral cinnabar, with a synthetic vermilion being manufactured from mercury and sulphur from the 9th century. Both are dense, opaque, brilliant reds but do darken over time unfortunately.

Red lake, a plant/animal based pigment, has been used where a more translucent red is required, but the lake pigments (yellows as well as reds) are vulnerable to fading in light.

Red lead was one of the earliest artificially prepared pigments and is made using lead oxide.

It was used by Byzantine and Persian illustrators (below), as well as in European manuscripts and paintings.

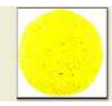
Vermillion is an orangish, red pigment with excellent hiding power and good permanence. It's a mercury sulphide mineral (cinnabar) used from antiquity through to the present though only scarcely due to its toxicity. Made artificially from the 9th century, it was the principle red in painting until the manufacture of its synthetic equivalent, cadmium red.

Cadmium red (above) was a favourite with Henri Matisse. He was keen on this strong new red. This is basically cadmium yellow (cadmium sulphide) with some selenium added instead of sulphur (cadmium selenide). Mineral pigment produced from cadmium sulphide when heated with selenium becomes red.

Yellows:

Orpiment was used by the ancient Greeks and Persians and is made from arsenic sulphide. It can be seen in this papyrus from the 13th century BC.

Before the 19th century, artificial yellows were manufactured, such as lead-tin yellow used from the 14th century often to depict gold.



Lead-tin yellow was produced by firing oxides of lead and tin in a furnace to over 800 degrees c. This produced either a pale primrose or deep daffodil powder which was reliable, dense and opaque. In the 17th century a modified yellow replacing tin with antimony (**Naples yellow**) became the standard. It has a warm, pinkish yellow tone, less bright than lead-tin yellow.

By around 1820 a whole range of new yellows based around compounds of chromium began to be manufactured, the most well known of these being **chrome yellow** (lead chromate). These, and later **cadmium yellow** became the most important yellows of the 19th century. Turner, for example, was a great lover of chrome yellow.

Cobalt yellow was an expensive yellow that was briefly in vogue. It is of very pure yellow colour and is lightfast but has only fair hiding power. Introduced as a pigment in 1852, it replaced an earlier pigment called Gamboge, an Asian yellow gum used until the 19th century. Cobalt yellow remained popular until the late 19th century, when less expensive, cleaner and more lightfast pigments like the cadmiums were introduced.

Chrome yellow was a relatively inexpensive yellow pigment with high covering power but with only fair lightfastness and chemical stability. The chrome colours were in use by 1816 but on a limited basis. Because the pigment tends to oxidize and darken on exposure to air over time, and it contains lead, a toxic, heavy metal, it has been largely replaced by cadmium yellow.

Cadmium yellow: Stromeyer discovered metallic cadmium in 1817 but production of the cadmium pigments was delayed until about 1840 because of the scarcity of the metal. A natural mineral, green ochite, is known in nature but was not used for pigments. Cadmium sulphide was prepared with an acid solution of cadmium salt (either chloride or sulphate) which was heated with hydrogen sulphide gas until a powder was formed. Hues ranging from a lemon yellow to a deep orange were made in this way.

The deeper varieties of cadmium yellow and orange were the most permanent. The paler varieties were known to fade on exposure to sunlight. All of the cadmiums were brilliant and the deeper shades had the greatest tinting strength. Apparently, the best cadmiums were those produced without an excess of sulphur and that the permanence of a carefully made cadmium was improved when mixed with lead white using only an ivory knife. They were used in both oil and watercolour but could not be mixed with copper-based pigments.

Cadmium yellow was discovered in 1818 and continues in use today.

Chrome orange is a basic lead chromate which was introduce as a pigment in 1809. The colour of the pigment can range from light to deep orange, the hiding power is excellent. The world production of chrome orange ceased few years ago. Now it is an obsolete pigment.

New Scientist (4 October 2014): Art conservators recently investigated the reason why the yellow paint in a number, but not all, of Van Gogh's Sunflower series had turned a dull brown. Using X-Ray technology, they were able to examine the chemical elements present in the pigment. Van Gogh had painted with chrome yellow (lead chromate) and the analysis showed around 2/3 of the chromium in the darkened samples had changed from bright yellow chromium (VI) to a darker green chromium (III), also known as viridian green.

When examining why this only occurred in some paintings, they discovered that in an attempt to make some of the yellows even brighter, Van Gogh had mixed his chrome yellow with a white powder based on lead sulphate, causing the sulphate to react with the chromium under the influence of light.

Whites:

One of the essential colours in the palette, the principle white pigment used from early times until the early 20th century was lead white, a poisonous lead compound formed as a white corrosion crust on metallic lead exposed in closed vessels to sour wine (acetic acid) in the presence of carbon dioxide.

Lead white has the warmest of all the whites. It has a very subtle reddish-yellow undertone that is almost unnoticeable unless you are looking for it, or comparing lead white side by side with other kinds of white. This undertone is minimal in the best quality of lead whites. It was the only white used in European easel paintings until the 19th century when its poisonous lead content restricted its manufacture and sale as an artist's pigment. In the early 20th century it was replaced by non-poisonous whites made from zinc and later titanium.

Lead white is also the fastest drying of all of the whites because of the drying action of the lead pigment upon the oil. This makes lead white particularly valuable for painters who need a relatively fast drying time for underpainting or Alla Prima techniques.

Black Angels in a XIV Century English Manuscript?

Byzantine illuminated manuscript, series of readings based on the gospel, 1220, British Library.

The British Library, which has owned the book since the early 19th century, found out that large areas of the 60 richly coloured illustrations had turned black. The lead white pigment mixed with red pigment for the flesh tone has turned to a black compound—lead (II) sulphide—due to the reaction between lead white and hydrogen sulphide emitted by the gas lamps used in the museum in the Victorian age.

Titanium white is the strongest, most brilliant white available to artists in the entire history of art. Excellent hiding power and with twice the opacity of pure lead white. Its chemical stability is likewise outstanding. The pigment's natural ore is rutile (titanium dioxide) and manufacturing it as a pigment presented difficulties. It was not until 1921 that American and Norwegian companies began to develop its production for painting. Most supplies of its ore come from Norway today. There are many industrial grades of titanium white pigment, none of which are used in their pure form for artists' oil colour. It is truly an all-purpose white oil colour. Since titanium dioxide, by itself, dries to a spongy film and zinc oxide dries to a brittle film, the two are combined in a balanced blend for better quality, professional grade titanium white. In some brands, where zinc oxide predominates in the mixture, the colour is called titanium-zinc white.

An important use of titanium dioxide is in powder form as a pigment for providing whiteness and opacity to such products as paints and coatings but also plastics, paper, inks, food and cosmetics, including most toothpastes.

Another use is as an opacifier for ceramics. Whiteness or opacity is introduced into transparent and colourless glass ceramic coatings by adding a phase (opacifier) that disperses as discrete particles to scatter and reflect some of the incidental light. The particles are chosen among oxides with a high refractive index. The most ancient oxide ever used is cassiterite (SnO_2). Today, rutile (TiO_2, titanium white) is commonly used. Indeed, titanium white is unaffected by heat and therefore it is commonly used in pottery glazes and enamel which require a high baking temperature. In the 19th century, titanium compounds were used for porcelain glazes and crystallites of TiO_2 formed during firing generated opacity.

Blacks:

Most black pigments come from natural carbon based sources – charcoals from a variety of woods, soot and graphite.

Browns:

Umber is a natural mixture of iron and manganese oxides and hydroxides. Used throughout history, it has earth-tones from cream to brown, depending on the balance of iron and manganese compounds, and is totally stable. This pigment is known also has Sienna earth.

It comes in two varieties:

Raw earth umber *(Raw Sienna earth)*: the earth just mined and ground into a pigment.

Burnt umber *(Burnt Sienna earth)*: the raw earth umber pigment is also calcinated in order to get darker shades.

Frans van Mieris, Pictura (An Allegory of Painting),1661, private collection

In a painting by Vermeer's contemporary Frans van Mieris, the allegorical figure representing *Pictura* can be seen holding a typical palette. Van Mieris' represented the palette necessary for painting flesh tones. The layout of the pigments, from light to dark, was common. From top to bottom, one can clearly distinguish white lead, the principle component of the lighter flesh tones, then yellow ochre, vermilion, madder lake, green earth, umber and carbon black.

Greys:

In Renaissance times both bismuth and antimony were mixed with white to form grey pigments.

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International Cadmium Association (ICDA)

European Chemicals Agency (ECHA)

LETTER FROM NORTH AMERICA

Dear Members,

Here in New York, our stunning summer appears to be changing rapidly into a pretty dodgy fall. We had some chilly weather the other night when it dropped to nearly freezing. And we've had continuous rain for the past couple of days. My sincere commiserations, though, to all in the UK (and elsewhere) who were hit by the remains of Hurricane Gonzalo.

The results are in! Has the Dodd-Frank Act of 2010 been a success when it comes to conflict minerals? Well, actually, no!

When it came to June 2, the deadline for filing, just ***four*** companies, out of a universe of some 6,000 issuers (both U.S. and foreign companies that file reports with the SEC), had had their Conflict Minerals Reports (CMRs) audited for the calendar year 2013 and could describe their products as "DRC Conflict Free". As also noted in Schulte Roth & Zabel's excellent white paper, Conflict Minerals Report – A Review of Calendar Year 2013 Filings and Recommendations for Calendar Year 2014 Compliance – a total of only 1,315 Form SDs were filed. (Unique filings were slightly lower.) Whatever the excuses, and there are many, a 22% filing rate can, I believe, only be described as a questionable accomplishment.

It should then, perhaps, not come as a surprise, that, at a speech at Fordham University School of Law here in New York in mid-October, SEC Commissioner Daniel Gallagher Jr. said that his organization should not be responsible for "*many, if not most*" of its Dodd-Frank mandated responsibilities, including, in this context, issuers' CMRs. According to Commissioner Gallagher, the Department of Defense, Army, Marines, or the Department of State could all be better at the job. Many would agree.

So, seeing as how I'm writing from North America, I thought I'd have a quick look for any recent reports about the Comprehensive Economic and Trade Agreement (CETA) between Canada and the EU. Well, the Canadian government certainly likes what it has negotiated (but not yet signed), describing it as "*historic*" and "*Canada's most ambitious trade initiative, broader in scope and deeper in ambition than the historic North American Free Trade Agreement.*"

And others? Well, it appears that, for a start, Germany is none too happy with the final text and could squash the whole thing, particularly when it comes to possible new powers for foreign investors. Unite, too, the union in the UK and Ireland, was particularly concerned when draft wording of the agreement was leaked at the end of September. But as to any official reaction from the UK government to the investor-state dispute settlement (ISDS) chapter, and whether it believes that, as worded, the agreement *does* actually ensure that governments always retain the right to regulate, I can find nothing. Nor can I find any recent analysis on any potential benefits that may accrue to the UK, as a member of the EU, from the agreement. I should welcome any information on this that members may have.

On that rather bemused (and concerned) note, and in the hopes of seeing some of you in London for the Xmas Lunch (I shall, surprisingly, be over), I remain

With best wishes, as always, from New York, to MMTA members everywhere.

Tom Butcher, October 24th, 2014 Hard Assets Investor ©2014 Tom Butcher

BOOK NOW FOR THE MMTA'S CHRISTMAS LUNCH

Wednesday 17th December 2014 from 12—4pm

Ironmongers' Hall, London

Celebrate the festive period with friends, colleagues and clients.

A festive networking Drinks Reception will be followed by a 3-course lunch with wine and a glass of port!

Cost: MMTA Members: £80 Non-members: £105 (+ VAT where applicable)

MINOR METALS IN RENEWABLE ENERGY TECHNOLOGIES – MMTA SUSTAINABILITY WORKING GROUP (SWG)

The MMTA's Sustainability Working Group has published its first guide on how minor metals contribute to a sustainable economy through their use in Renewable Energy Technologies.

The full report is available for download at http://www.mmta.co.uk/sustainability.

Renewable energy technologies have grown massively in the last decade, with technology breakthroughs, support from policy makers and development of infrastructure.

Photovoltaic (PV) panel manufacturing has been transformed into a mass production industry in the last five years, in thin-film technologies, as well as in Si-based technologies (thick-film), which currently dominate the sector. Wind energy turbine installations have also grown significantly in number in recent years, with an increasing use of Rare Earth Element (REE) permanent magnets for efficiency.

Minor metals are essential raw materials in the production of photovoltaic systems, wind turbine magnetic motors and structures, and will remain so, even with technological advances, due to their unique technical properties. Many minor metals are described by governments and policy makers as 'strategic' or 'critical' due their exceptional characteristics, supply constraints—perceived and actual— and importance for ensuring a sustainable future.

How Minor Metals Contribute

Photovoltaics (PV)

Minor metals used in photovoltaics – silicon, indium, gallium, cadmium, tellurium, selenium

Photovoltaic cells (PV) are made up of two semi-conducting layers, one layer containing a positive charge and the other a negative. Photons from sunlight excite electrons into a higher state of energy allowing them to act as charge carriers for an electric current.

The main commercial PV materials today are:

- Crystalline silicon (c-Si)
- Amorphous silicon (a-Si)
- Cadmium telluride (CdTe)
- CIGS (or CIS), an alloy of copper (Cu), indium (In), gallium (Ga) and either selenium (Se) or sulphur (S)

Technologies based on crystalline silicon use relatively thick and rigid wafers in solar panels, whilst others are thin-film technologies.

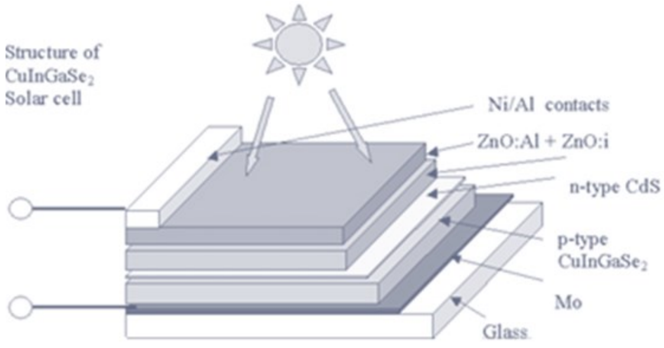

Figure 1 shows a CIGS solar cell

Wind Energy

Minor metals used for wind energy- chromium, manganese, molybdenum and rare earths: neodymium and dysprosium

Land-based turbines still account for 98% of all installed capacity but both Industry and academia agree that future focus will be on larger turbines situated offshore.

The basic principle behind wind turbines is that kinetic energy in the form of wind moves the blades, driving a generator. REEs neodymium and dysprosium are used in the generator in permanent magnets. Permanent magnets reduce the size and weight of the generator. Slow-speed turbines generate more electricity at slower wind speeds, but these require larger permanent magnets, which consequently require more REEs.

Wind turbine technology is divided between permanent magnet and electromagnet generators and between geared and gearless transmission. Studies have estimated that 20% of global wind turbine installations between 2015 and 2020 are likely to use permanent magnets, rising to 25% for the years 2021-2030.

The other minor metals mentioned: chromium, manganese and molybdenum are to be found in the steel used to build the turbines, in order for them to withstand sometimes extremely hostile and corrosive environments, particularly in offshore installations where salt spray and high winds test the wind turbines to the maximum.

Next...How Can Sustainability be Good Business?

The Sustainability Working Group's next piece of work will be a Guide to Sustainability for SMEs – stay tuned!

If you are interested in Sustainability, contact the Executive Team for ways to get involved.

Economic Outlook for China – A Women in Mining (WIM) Seminar

On the 9th September, the MMTA attended a Women in Mining Seminar at the Houses of Parliament in London, focussing on the economic outlook for China after the recent slowdown in growth. The evening was chaired by Eric Joyce MP for Falkirk.

The first presentation was The Commodities Super Cycle: How do capitalist economies work? The theme was that Commodity Super Cycles consist of a 15-20 year up cycle followed by a 15-20 year down cycle. This pattern has been measured since 1788, with commodity intensive wars often acting as catalysts for an up cycle. The drivers of Super Cycles are debated, but the speaker focused on two: The first, monetary factors: cheap money pushing commodity prices up, and the second, industrialisation. Today's cycle began in 2001 with China also joining the WTO in the same year. In 2000, China began an aggressive investment plan, with heavy commercial use of steel, growing so much that China consumed half of the total world market for steel in 2010 (and was responsible for all of the growth in 2010).

Where is China today? Credit is at twice the GDP; this is one of the fastest credit booms in the developed world. Generally these credit booms don't end well, and there is evidence of a downturn, given the estimated 70 million properties in China that are un-occupied. The speaker concluded that at the moment, China is experiencing a pause with excess capacity in a number of commodities.

The second speaker, Sha Luo PHD from CRU Consulting, asked the question 'Is China's slowdown a problem for commodities industries?'

Currently, 14% of Chinese GDP is in the metals and mining sector, however, the decline is beginning. The following are the five main challenges that need to be overcome, according to Sha Luo:

Resource constraints. Can China satisfy its own demand? China is a net importer of all raw materials and net exporter of finished products. Therefore, China is vulnerable to global markets. It is therefore developing scrap/recycling and buying up overseas deposits to secure resources.

Environmental Issues and the war on pollution. The environmental problem is now too serious to ignore and therefore there is a lot of new regulation to tackle polluters. China needs to improve the environment without killing its industry with high green taxes, so a careful balance needs to be struck. A very positive development is that some producers have taken the decision to be leaders of change rather than waiting for the inevitable to be imposed upon them.


The MMTA Executive Team enjoying the echelons of power

How to accommodate this demand? The relationship between demand and economic activity is crucial, an example being steel, where there is a huge over capacity. Supply and demand are not balanced, meaning that a restructuring of industry is needed. The top 10 producers only make 50% of steel, but there are many socio-political challenges involved in restructuring, with many layers from the government, local government, as well as businesses themselves, to overcome. Why is China still importing, despite this over-supply? One reason is that overseas ores contain less sulphur and are cheaper.

Rising Labour & Production Costs. The state-owned sector is very large in China, especially in metals and mining. China is losing its competiveness: the cost of labour and the cost of energy have increased; plants are starting to move to cheaper areas such as Vietnam and India where a cheaper, English-speaking labour force is readily available. China wishes to move up the value chain and create more advanced, higher-value products.

Domestic Margins Will Stay Under Pressure. There are still huge opportunities, and China will still continue to drive commodity markets. There will, however, be more challenges ahead. **MMTA Executive Team**

NEWS IN BRIEF

FOR SALE

www.minormetals.com

Fastmarkets is currently considering selling the minormetals.com domain name, and would like to hear from any interested parties.

If you would be interested in acquiring the www.minormetals.com domain name, please contact Dominic Hall of Fastmarkets for more information at

dominic.hall@fastmarkets.com.

The Fanya Metal Exchange Holds its first Strategic Metal Entrepreneurs' Summit

For those keeping an eye on developments at the Fanya Metal Exchange, it was with interest that we learned about Fanya's recently held first Strategic Metal Entrepreneurs' Summit, held jointly with the China Chamber of Metals, Minerals & Chemicals Imports & Exports in Beijing on October 31st.

The main focus of the event was on the integration of industry capital and financial capital against a background of the financial internet. The event was attended by over 300 delegates from government, financial agencies and the non-ferrous metal industry, and provided Fanya with the opportunity to launch its listing of two rare earths—dysprosium oxide and terbium oxide, both new to the exchange. According to Fanya's report of the event, both listings were sold out in a matter of seconds.

To see the full event report please follow this link:
http://www.fyme.cn/english/news/2014/1105/25540.html

MMTA 41st Anniversary Dinner

21st October 2014

Intercontinental Hotel, Park Lane, London






A huge thank you to our Drinks Reception Sponsor
Avon Metals

and our Main Dinner Sponsor, **Argus Media**,

for helping to make the event a great success again this year.




Many Thanks

to all those who took part in the charity business card raffle in support of the MMTA's link with

Mufulira in Zambia, this year sponsored by

Alex Stewart International

We raised a wonderful £1,565 on the night, which has been forwarded to the charity.

For an update on developments in Mufulira, please see Anthony Lipmann's article in this edition.




How Glencore did the right thing and how the MMTA was part of the story

In 2008 I travelled to Mufulira in Zambia for the first time. After 30 years of knowing the name, it was good to be there. As MMTA members know, it is the place where the British mined copper from the late 1920s and is synonymous with the red metal. So steeped in copper is the town, that the locals cannot conceive of life without it. I was regularly asked how we mine copper in London and Somerset.

Today, schools in Somerset have been twinning with Mufulira for 20 years and, more recently, the exchange programme has been funded by donations from members at our annual dinner and other events. It is a charitable link that makes sense – a metals industry reaching out to a metal town.

But just to remind MMTA members, let me tell you about our journey from 2008. The town I visited in that year was still blighted by sulphur emissions vented to the atmosphere for as long as the smelter had been in operation. The lives of 300,000 were affected daily. It is the particular feature of sulphur that, if inhaled, the victim feels choked. However irrational, the person feels he is being strangled.

MMTA became part of the advocacy for removal of airborne sulphur and perhaps our representations were taken seriously because we are of the metal trade and not an NGO with a world agenda.

Today, all airborne pollution is gone and that is thanks not to the British, or the Zambians under ZCCM, (neither of whom captured sulphur), but to Glencore.

The purpose of my trip just now in October 2014 was to witness this transformation. From a smelter that emitted sulphur to one that recycles gases from every part of the plant and safely recovers all other deleterious elements. Instead of emissions to the atmosphere, the plant produces 2000 metric tons per day of safe industrial sulphuric acid, some of which is used for electrolysis in the refinery.

Perhaps you will gain a better impression via the 'before' and 'after' photos included in this report.

Therefore, in summary, I would like to be the first to pay credit to Glencore who spent $500 million to do this job. As far as I can tell, it is to the highest world standards. At the same time, they have been open with me and our groups from Somerset, inviting us to see progress on our annual visits and always available to answer questions too.

Apart from the acid plant, Mopani has opened a state-of-the-art training centre for locals to learn skills as fitters, boiler-makers, electricians, mechanics. We have seen new clinics in the community, a cervical smear programme, newly-built roads, the restored football stadium (home to the Mufulira Wanderers) and many more examples all attributable to Glencore's work in the community.

I heard it said that Mopani is now regarded as the best mining company in the copperbelt and best payer too. That is a reputation well-earned.

The MMTA's linking with the community will not end. We have completed storage tanks at Kamuchanga Hospital and the new laundry is now working. A second stand is serving the Robin's Nest Orphanage. The previously donated anaesthetic machine is still saving lives and the autoclaves for sterilising surgical instruments are giving good service .

If anyone from the MMTA is travelling in Zambia, please feel free to contact me and see the work that is being done and see for yourself a little part of this story.

Anthony Lipmann, Lipmann Walton & Co. 31.10.14

The site before—Photo courtesy of Anthony Lipmann

After—Photo courtesy of Hilary Forward

After—Photo courtesy of Hilary Forward

For more on this development, see Lord Copper, entitled 'How Glasenberg did the Right Thing in Zambia'.

See also, the Glencore website at http://www.glencore.com/assets/sustainability/doc/140608-Mufulira-Smelter-Upgrade-Project-comletes.pdf

BEWARE FRAUDULENT CONSIGNMENTS WHICH INSURANCE MAY NOT COVER

In the last couple of years, we have been consulted by a number of buyers who have been sold consignments which turned out to be fraudulent. In each case, the product was weighed, stuffed and photographed in containers as part of the pre-shipping survey. At some point prior to delivery, the product was switched with rocks, soil or sand. The switch was discovered on delivery at the discharge port or consumer's premises when the containers were unloaded. It is suspected that the switches took place in transit prior to loading onto the ship, possibly by container doors being unscrewed to allow the contents to be switched whilst keeping the door seals intact.

The buyers all had marine insurance claims declined because they could not prove that the goods they bought had been shipped. Typically, such insurance policies only provide cover from the start of the journey when the goods are loaded onto the ship. It is therefore vital to obtain evidence that the goods were indeed loaded on board at the start of the journey for the insurance policy to provide cover.

Inspection of the goods at the time of stuffing in the supplier's yard is insufficient, as the goods can be tampered with between stuffing and loading on board the ship. Appointing an expert surveying company to supervise from stuffing to loading and to certify that the goods have been loaded on board in compliance with the contract is a way around this. They may also be able to add their own seal, as well as the shipping seal, to verify that the goods were indeed loaded on board.

Also consider the wording of your policy. How is the start of the journey defined? Is road transport covered?

Knowing who you are buying from also helps to prevent fraud. If the seller is a company that you haven't done business with before, ensure you make additional enquiries. Be particularly cautious when dealing with newly incorporated companies with no trading history or reputation.

To summarise:

Try to deal with people who you know or who are reputable in the market wherever possible;

If you don't know the seller, appoint an independent party to inspect the goods and be present when the containers are loaded on to the ship. If the goods are then subsequently switched, it will be clear that this happened after loading when the loss of the goods should be covered by marine insurance.

Nicole Finlayson, Senior Associate, Penningtons Manches LLP

NEW MMTA MEMBER

湖南金旺铋业股份有限公司
HUNAN JINWANG BISMUTH INDUSTRIAL CO.,LTD

Hunan Jinwang Bismuth Industrial Co., Ltd—The Global Leading Bismuth Metal and Bismuth Chemicals Manufacturer

Based in Chenzhou City, Hunan Province, P.R. China, Hunan Jinwang Bismuth Industrial Co., Ltd ("Jinwang") was established in April 2001 and specializes in the production of high purity bismuth metal as well as bismuth chemicals. With more than $280m total assets invested and $435m turnover in 2013, Jinwang is the only fully vertically integrated player in the field with operations starting from its own mining assets (crushing, smelting, refining, separation) right through to the production of a very broad range of bismuth products used in a number of industrial, electronics and pharmaceutical applications.

With a newly finished plant, Xianxi, the company is currently the largest bismuth recycling base in China. It uses an oxygen -rich side-blown smelting furnace and bismuth electrolytic refining process, which is the world's first such technology. Compared with traditional methods, this new one can adapt not only a variety of materials, but also greatly reduces the energy consumption of smelting. More importantly, the output of the flue gas contains more SO_2 to be produced as sulfuric acid. This means that the long-term environmental protection difficulty of the pyro-metallurgical refining bismuth industry is fundamentally solved. Meanwhile, all of the industrial wastewater from the whole plant is collected into the water treatment plant. The water is recycled and reused after treatment, achieving zero discharge of wastewater. Dust removal and desulfurization equipment for waste gas treatment is installed to ensure that the exhaust emissions meet the standards. The slag is sent to a cement plant as raw ingredients after evacuation by water quenching, in order to make it a truly resource-saving and environment friendly Green Plant.

The bismuth products of Jinwang have been registered for REACH, and are therefore permitted to enter into the EU market. Jinwang has also met the requirements of ISO 9001 and ISO 14000 and acquired Certificate of GMP for its bismuth Parma products.

Now that the 2 million sq-ft plant, Xianxi, is fully operational, Jinwang is capable of producing high-purity bismuth (8,000 tonnes), ultra fine bismuth oxide (3,500 tonnes), Parma bismuth salts (1,000 tonnes), silver (500 tonnes), tellurium (300 tonnes), gold (10 tonnes) and a variety of metal recovery including lead, antimony, and copper.

Jinwang wishes to co-operate with friends all over the world based on the principles of Equality, Mutual Benefits, and Credit Standing in order to add value to the society.

Contact: Alex Wu

Email: wuyan@jin-wang.com.cn or sales@jin-wang.com.cn

Website: http://www.jin-wang.com.cn

Minor Metals in the body: Titanium

The 'Metals in the Body' series continues with titanium. The first titanium mineral was discovered in 1791, with titanium metal isolated in 1910. Titanium, however, quickly became a prized, strategically important material in the 20th Century and especially during the space race and cold war. Not only is titanium being used to explore beyond our planet, but it also has many diverse applications in and on the human body. A comforting thought for those who may have some titanium spare parts is that it is possible to recycle these components at end-of-life, a rather neat example for Life Cycle Assessments.

Titanium has some impressive properties which include being high strength and lightweight, making its various well-known aerospace applications obvious. However, it is its outstanding corrosion resistance, non-toxicity and bio-compatibility that lend it well to the medical sphere, which includes surgical implants and surgical tools. Titanium's corrosion resistance is thanks to a thin layer of titanium dioxide making it impervious to most extreme conditions.

Another notable aspect of this metal's bio-compatibility is with bones. Titanium has the property of being able to fuse together with living bone, a process called osseointegration. The bone forming cells attach themselves to the titanium implant and a structural and functional bridge forms between the bone and the newly implanted, foreign titanium object, no other tissue is formed between the implant and bone.

Properties

Medical-grade titanium is stronger than stainless steels or cobalt chrome alternatives but is also lighter, meaning that where cost is not the key consideration, titanium has the technical advantage. Titanium can be made with variations on its characteristics from highly-ductile commercially pure metal to alloys with higher strengths and fatigue properties, gained from various additions.

Uses

Today, titanium alloys find extensive use in military, aerospace and marine applications, due to the above-mentioned properties. Titanium's industrial applications are also a major market sector. Nearly all acids and hot liquids can be passed through titanium tubes or stored in titanium. Market factors such as price volatility impede titanium's greater use in the automotive sector.

A small proportion of the titanium market, namely ferro-titanium, is largely dependent on the outlet of titanium scrap (likely to be where titanium body parts end up), as well as the workings of the steel industry, due to its application; and thus this market moves with steel production. (see September 2014 Crucible for more on ferro-titanium)

Now on to its many medical applications…

Dental

As mentioned, titanium has the ability to fuse together with living bone. This property makes it a huge benefit in the world of dentistry. Titanium dental implants have become the most widely accepted and successfully used type of implant.

NEW MMTA MEMBER

Zuidnatie NV is a logistics company based in Antwerp, Belgium. The company was founded in 1870 and has grown into one of the major players in the port of Antwerp. Zuidnatie disposes of two deep water terminals in the port, specializing in handling break bulk cargos, amongst which both ferrous (iron and steel products) as non ferrous metals. One of these terminals also hosts an empty depot function for various major container lines, giving us an advantage on both imports and exports. Added value activities are on site, such as a cutting machine for metals (Ni and Cu), a steel slitting facility, and a dedicated fumigation area. The terminals are AEO and ISPS approved, and fully fenced/gated, guaranteeing the security the market is looking for. We have both MMTA as LME approved facilities on site, offering all services required in this line of business. An in-house customs brokerage company, our own trucking fleet for both containers and conventional trucks including silo trucks, a barge shuttle service to the main container hubs, a packing facility, and, last but not least, a dedicated team to assist you with all your enquiries.

Our website also gives you additional information – please check www.zuidnatie.be

Our new MMTA warehouse is situated on our Terminal Zuid, at quay number 118 (TZ118). This is a 300k sqm terminal with access by road, rail and water, including 15 warehouse units with a total capacity of 150k sqm covered space. One of these will be dedicated to the minor metal business, with a specific desk assisting you – for all enquiries, please contact Bart Van Gils.

Email: b.vangils@zuidnatie.be

ZUIDNATIE

Surgical tools

Titanium is incredibly durable, giving instruments greater longevity, as well as being bacteria resistant and being useable with radiation emitting tools. Some tools often made of titanium are surgical forceps, suture instruments and dental drills.

Artificial hips, knees and other spares

Some of the most common and well known uses for titanium are in hip and knee replacement surgeries. It is also used to replace shoulder and elbow joints. Titanium pegs are used to attach false eyes and ears and titanium heart valves are even competing with regular tissue valves.

Titanium has a well-matched Young's modulus with bone, and so skeletal loads are distributed equally between the host bone and the implant. This leads to a lower risk of bone degradation from stress shielding and subsequent fracture. A titanium hip replacement can remain fully functional for 20 years, and titanium dental implants have a lifetime of more than 30 years. Furthermore, titanium is non-ferromagnetic, so patients with implants can be safely examined using MRI scanners.

Not strictly a medical necessity, but the non-allergenic property of titanium also makes it popular for use in the body in the form of body jewellery such as tongue studs and eyebrow rings.

Problems with titanium implants

Although an exceptional material, titanium implants do not come problem-free. Titanium is twice as stiff as bone, meaning that the bone bears a reduced load, which can then deteriorate, loosening the implant and causing further problems. For screws and plates, the titanium needs to be carefully selected in order avoid poor shear strength. The toxicity of the alloying elements also need to be thought about, for example vanadium can be toxic to cells, so niobium may be a preferable choice while maintaining strength and bio-compatibility.

Titanium-dioxide

As it is actually the majority of the titanium market, it would be remiss not to mention titanium dioxide in the context of its use on humans. It is bright, white and highly opaque, so it is used as white pigment in paints (as mentioned on page 9 in this edition), paper, toothpaste and plastics. Titanium dioxide nano-particles absorb UV light and scatter visible light, making them excellent additives for sunscreen, which is invisible on the skin.

Tamara Alliot, MMTA

NEW MMTA MEMBER

FAM International Corp

FAM is first of all very honored and proud to be the very first Korean company - being wholly headquartered in Seoul, S. Korea - to become an MMTA Member.

FAM is a trading house specializing in various minor metals, as well as secondary & primary non-ferrous metals, raw material and chemical products. With over 30 years' experience & relationships in the industry, we are proud that FAM has carved out its own unique position in both the international and home markets.

FAM, through the continuous expansion of our sales networks, business scope, and utmost services to our valuable partners, aims to achieve our vision of becoming the national No. 1 trading house for minor metals, chemicals and their raw material, all within one business.

Contact: Ms Sue Oh
Email: sales@fam-intl.com

Website: www.fam-intl.com

FAM International Corp.

IT'S TIME TO REGISTER FOR THE NEW YORK DINNER—ONLY 3 WEEKS TO GO!

Circus Restaurant, New York, USA, Thursday 4th December 2014 from 6pm

Brazilian themed evening * Welcome Caipirinha * Networking Drinks Reception * Open bar * Authentic Brazilian menu with a modern twist

Pre-Dinner Speaker: Mr. Andre Sharon, Consulting Research Analyst, Euro Pacific Capital, Inc, before which he was Head of Global Research Product Development at ABN-AMRO

Cost: $150 for MMTA Members $200 for non-members (or GBP equivalent)