THE SFP CADMIUM PRESS REVIEW

21st February 2005

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by Roland Chavasse

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Cadmium Metal Quotes

LMB Free Market 21st February 2005

$/lb in warehouse	Low	High
Min. 99.99%	0.85	0.95
Min. 99.95%	0.75	0.85

Metal Pages 17th February 2005

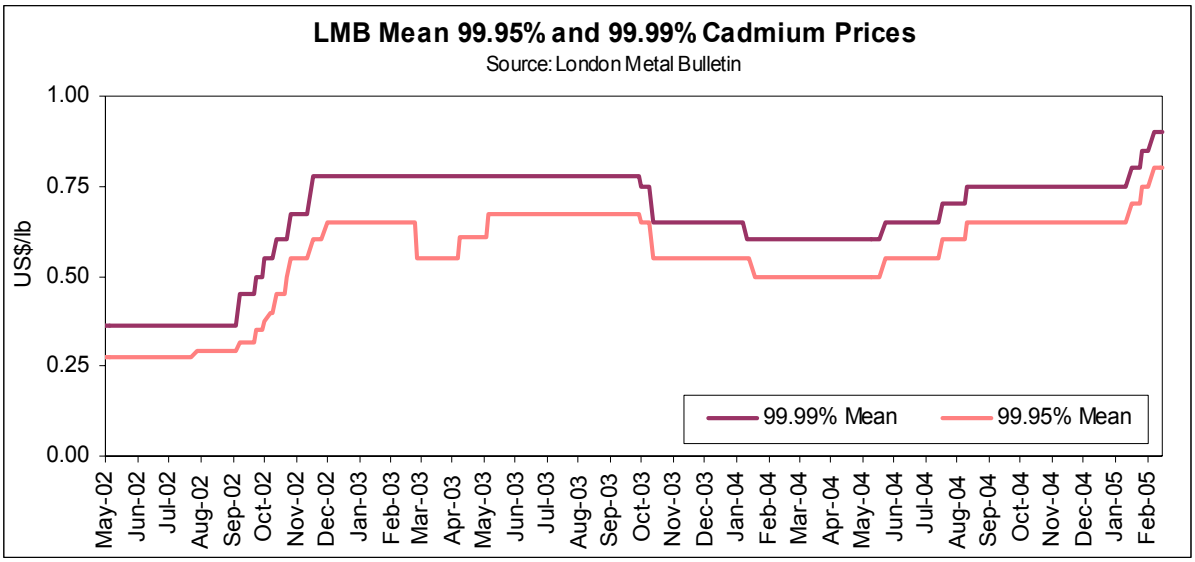
$/lb in warehouse	Low	High
Min. 99.99%	0.85	0.95
Min. 99.95%	0.75	0.85

Platt's Metals Week 14th February 2005

$/lb in warehouse	Low	High
Free Market HG	0.90	1.00
MW NY Dealer	0.80	0.90

Ryan's Notes 11th February 2005

$/lb in warehouse	Low	High
Min. 99.95% (Rotterdam)	0.70	0.75



WBMS World Refined Cadmium Production and Consumption 2001 - 2004

(all in MT) Year	2001	2002	2003	2004 (Jan-Nov)
Production	17,597.2	16,209.5	16,862.8	18,097.6
Consumption	18,062.1	19,240.4	19,443.7	17,301.6
MARKET BALANCE	-464.9	-3,030.9	-2,580.9	796.0

Currencies and Commodities

Financial Times Currency Market Data: 18th February 2005	
Euro (€) per US Dollar ($)	0.77
Pound Sterling (£) per US Dollar ($)	0.53
Japanese Yen (¥) per US Dollar ($)	105.49

Cadmium Market Executive Summary

MARKET ROUND UP

1) Cadmium, which has also started to show signs of life since the start of the year, stands at 75–85 cents per lb for low grade 99.5% material while 99.99% cadmium is changing hands at around 85–95 cents per lb. Dwindling stocks and higher demand for batteries in China have propelled prices upwards, a second UK trader said. But not all in the market agreed and some mentioned "an invisible ceiling" on prices and stocks in Rotterdam.

[Metal Bulletin 17/02/05. Read source article? – See page 6]

2) Increasing strong demand for cadmium has resulted in prices finally moving up with business for several trucks of 4N material being concluded at 99 cents/lb delivered in Europe and a smaller tonnage at just over $1/lb. Power cuts in China, one of the main end users, has resulted in several Chinese smelters cutting production. Whilst the Chinese are on holiday, western consumers have taken the opportunity to secure material before the Chinese return when they are expected to come into the market with addition demand, pushing prices higher again. Lower grade 3N5 material is said to be traded in a range of 75 – 85 cents/lb.

[Metal Pages 11/02/05. Read source article? – See page 6]

3) Cadmium prices have risen on strong demand and a shortage of material. Markets are tight as power shortages in China have hit a number of zinc-cadmium plants hard. The cutbacks in zinc production coupled with rising demand have increased prices by 10 cents on both grades of cadmium, a by-product of zinc. Higher grade 99.99% cadmium is being traded at between 85-95 cents per lb while 99.95% is changing hands at around 75-85 cents per lb. It is understood that some plants have sold out of material and will have no spot market material available for most, or all of the year.

[Metal Bulletin 10/02/05. Read source article? – See page 7]

4) Demand for cadmium is said to be good from the NiCd battery sector as well as the pigment industry and according to sources prices are firming. Supplies from some producers have tightened and gone are the huge Russian stockpiles of material. Currently China, one of the main consumers, is on holiday, but when they return prices may rise.

[Metal Pages 04/02/05. Read source article? – See page 7]

5) Cadmium prices are treading steadily upwards as traders report scant availability and increased buying in Asia. Both grades of cadmium have nudged up by 5 cents per lb, bringing 99.95% material to 70–80 cents and higher grade 99.99% metal to 80–90 cents. "Japanese domestic cadmium production has fallen while levels of demand haven't shifted so they are having to import more material as is China," a trader said. Meanwhile a trader based in Europe claimed to have sold 40 mt of 99.95% cadmium for 75 cents per lb. While demand for cadmium from the Japanese battery sector is rising, demand in China is also said to be good.

[Metal Bulletin 28/01/05. Read source article? – See page 7]

SUPPLY

IMMSA, Xstrata

6) The cadmium market is stirring, in part because supply has been decreasing on an almost yearly basis and the latest shortfalls to be reported are from the Mexican 3N5 producer IMMSA. Meanwhile, European producer Xstrata – which took over Metaleurop's zinc and cadmium operation at Nordenham in Germany – is sold out for 2005, according to sources close to the company and this material could well go next year if Xstrata is forced, by German environmental considerations, to close the cadmium circuit. At the moment, though, the best anyone can confidently say is that the cadmium price is unlikely to go down this year.

[Metal Pages 10/01/05. Read source article? – See page 8]

Portovesme

77) Glencore will close its Portovesme Imperial Smelting Furnace in Sardinia, Italy in the second-half of February. The decision to close the smelter has been reached as a result of the "unfavourable economics of the plant and ascended by high coke prices," company spokeswoman Lotti Grenacher said. Discussions are taking place to up production at Portovesme's electorytic zinc refinery, which has a capacity to produce 110,000 tons per year of zinc, Grenacher said. Production at the Portovesme lead plants will continue as normal. Portovesme has struggled with high power costs and was shut from October 2003 until August 2004. The zinc smelter has been operating at 20% capacity due to the power supply problems.

[Moneycontrol.com 04/02/05. Read source article? – See page 9]

Zinifex

8) Strong price forecasts for zinc and lead and a solid production performance in 2003 have buoyed investor faith in Zinifex Ltd. The flurry of interest in Australia's Zinifex came as the company confirmed it was on track to meet its 2004/05 production targets. Earlier, Zinifex gave upbeat price forecasts and said while lead prices were expected to come off the highs from 2004, they should remain above the long term average. Zinifex was formed out of the assets of the defunct Pasminco.

[TheAge.com.au 24/01/05. Read source article? – See page 9]

DEMAND

Batteries

9) Leading Indian battery manufacturer Exide Industries will make its first move into nickel-cadmium battery production in the next financial year, it has announced. The Kolkata based company intends to source the required technology from Europe and Japan. Exide is the number one Indian exporter of batteries, delivering to over 40 nations in Africa, Asia, Europe, the Middle East and South America.

[Metal Pages 16/02/05. Read source article? – See page 9]

10) The NiCd battery refuses to die, despite growing global pressure to limit the use of cadmium. Japanese production of the NiCd has increased, while China has also increased its cadmium consumption. Of course, there is always talk about moves afoot to phase-out NiCd but for the foreseeable future demand continues steady. It may be too early for cadmium producers to start popping the champagne corks, but cadmium over $1 is looking much more likely than it has for a very long time.

[Metal Pages 03/02/05. Read source article? – See page 10]

11) French battery manufacturer Saft has announced it would invest in a new plant in South China to build nickel-cadmium and lithium batteries for the Chinese rail transportation industry. Saft said it expects the plant to help meet ongoing demand from local rail manufacturers undertaking subway and high-speed train projects in several Chinese cities. Saft chief executive John Searle said in a statement "We have shipped more than 20m cells to China over the last three years and demand is growing for high added-value products such as ours."

[EeTimes.com 21/01/05. Read source article? – See page 10]

China

12) Chinese cadmium metal imports grew 21% in 2004, to an estimated 6,211 mt, against 5,119 mt in 2003. Although waste and scrap imports fell 43% to an estimated 938 mt, total cadmium imports rose 6% to an estimated 7,149 mt, against 6,752 mt in 2003. The move towards higher purity cadmium is an interesting move in the industry. Kazakhstan supplied the bulk of imports (24%), shipping an estimated 1,511 mt of cadmium, up from 662 mt in 2003. Since 2001 China has become the world's biggest cadmium importer, with its imports growing eight-fold since 1999.

[Metal Pages 04/02/05. Read source article? – See page 10]

IN OTHER NEWS

Aerogels

13) Scientists in the US have made the first ever aerogel with semiconducting properties. Aerogels a porous structures made from billions of pores between 2 and 50 nanometres in diameter. Most previous aerogels are electrically insulating, but now, using cadmium sulphide Stephanie Brock at Wayne State University created an aerogel with a bulk density of 0.07 grams per cubic centimetre, which is just 1.4% of the density of a single crystal of cadmium sulphide. The pore density means a gram of aerogel can contain a surface area of up to 250 square metres.

[Physicsweb.org 24/01/05. Read source article? – See page 11]

Miniature Lamps

14) Swiss researchers have developed a new kind of microscopic 'lamp' for use in miniature-scale nanoscopic systems. Made from nanocrystals of cadmium selenide, the 'lamps' glow green when hit by light of a certain wavelength. By passing the energy to proteins attached to the 'lamps' a red glow can also be generated. This is a significant development for diagnostics and bioanalysis and is likely to be used in analysis with DNA or protein chips.

[Chemie.de 02/02/05. Read source article? – See page 11]

Space Telescope

15) A new space-telescope could be orbiting Earth by 2009, taking the first high-energy X-ray pictures of matter falling into black holes and shooting out of exploding stars. Central to this cutting edge technology is an array of conical mirrors that will focus X rays onto a detector made of cadmium zinc telluride. The sensor is segmented into squares of about half a millimetre each, and these will take thousands of individual readings of X-ray photons and turn them into electronic signals. "With this mission, we'll open the hard X-ray frontier and look at things never seen before," said a professor of physics and astronomy at Caltech, USA.

[California Institute of Technology (caltech.edu) 05/02/05. Read source article? – See page 12]

Source Press Articles

1) Chromium rises on oxide shortage

Metal Bulletin 17/02/05

The price of chromium continues to increase on a shortage of chrome oxide despite a general slowdown in the minor metals market over the last week as China celebrated its New Year. Chromium has nudged up $100 and is now being traded at between $6,000 and $6,200 per tonne, with some sources in the market reporting even higher figures being achieved. A tightness of chrome oxide has sparked the surge on price, which has risen from $4,400-4,600 in October. “Talk of chrome oxide shortage has seen the price rise steadily over the past few months but I think when the shortage really bites we could see it fly,” said a London-based trader. Price rises might have been restrained because some sellers have not realised the extent of the chrome oxide shortage and continue to let metal go cheaply, the trader said. “Despite that, I have heard reports of a purchase taking place at $6,400 per tonne,” he said. Selenium, meanwhile, may have reached a stable plateau, according to some traders. “I think selenium is beginning to find a bit of stability now,” said a UK trader. The metal, which sits in a range of $42–45 per lb, has seen massive gains on a growing lack of spot material. The price sat at $11-$13 per lb a year ago. Cadmium, which has also started to show signs of life since the start of the year, stands at 75–85 cents per lb for low grade 99.5 percent material while 99.99 cadmium is changing hands at around 85–95 cents per lb. At the start of the year the prices were 60-70 cents per lb and 70-80 cents per lb respectively. Dwindling stocks and higher demand for batteries in China have propelled prices upwards, a second UK trader said. But not all in the market agreed. “The price has been pushed up by some people and is now trading higher than it really should be,” said the first UK trader. “It’s a completely manufactured price. There is material out there, everybody knows that, and demand is not surging upwards to make the price rise like it has. There is an invisible ceiling where people want to see it get to $1 per lb, but I don’t believe it will get there,” he said. A final source claimed that despite some traders going around talking of higher prices it is still possible to pick up material at lower prices. “There is cadmium in Rotterdam still and in some places good quality 4N material can be bought for close to 80 cents.”

2) MARKET ROUNDUP – waiting for the return of the Chinese

Metal Pages 11/02/05

[...] At the beginning of the week, Indium Corp of America raised its indium price by $165/kg to $965/kg slightly below the level at which most recent business was concluded. Increasing strong demand for cadmium from the nickel-cadmium battery sector and the pigments industry has resulted in prices finally moving up with business for several trucks of 4N material being concluded at 99 cents/lb delivered in Europe and a smaller tonnage at just over $1/lb. Power cuts in China, one of the main end users, has resulted in several Chinese smelters cutting production. Whilst the Chinese are on holiday, western consumers have taken the opportunity to secure material before the Chinese return when they are expected to come into the market with addition demand, pushing prices higher again. Lower grade 3N5 material is said to be traded in a range of 75 – 85 cents/lb. Although apparently quiet, some sales have been concluded for antimony at the equivalent of just over $3,100/tonne in Rotterdam for material with guaranteed low bismuth. [...]

3) Cadmium and selenium take minor leading roles

Metal Bulletin 10/02/05

Cadmium prices have risen on strong demand and a shortage of material caused primarily by power shortages in China that have hit a number of zinc plants hard. The cutbacks in zinc production coupled with rising demand have increased prices by 10 cents on both grades of cadmium, a by-product of zinc. Higher grade 99.99 percent cadmium is being traded at between 85-95 cents per lb while 99.95 percent is changing hands at around 75-85 cents per lb. “It's becoming increasingly difficult to get your hands on with many plants working hard to fulfil contracts,” said a UK-based trader. Some plants have sold out of material and will have no spot market material available for most, or all of the year, with their whole production focused on providing material to long term contracts, he added. The trader claimed to have sold at least one batch of 99.99 percent cadmium for delivery in April for $1.02 per lb. Other minor metals have stayed stable during a mostly quiet week of trading because of the Chinese New Year celebrations, but the potential remains for prices to climb. Selenium has shown considerable strength over the last year, but has picked up increasing momentum in the last few weeks. The metal has gone from trading between $31 and $35 per lb at the end of 2004 to its current price of $41-44. The market has again been driven by a growing shortage of material. “Producers simply cannot supply enough to keep up with the strong demand. There are just no additional stocks around,” said a London trader. “It's risen so quickly it's difficult to keep up,” said a second observer, who believed that prices could slow down or plateau. Elsewhere, indium remained strong but with very little sales reported over the holiday period. The price remains around $1,000 per kg at $990–1,030.

4) MARKET ROUNDUP – markets quieter pre the Chinese Spring Festival

Metal Pages 04/02/05

[…] Nippon Mining and Metals raised their domestic price for 4N indium this week to Y105,000/kg ($1,010/kg) for small lots and Y100,000/kg ($963/kg) for larger quantities. Demand for cadmium is said to be good from the nickel-cadmium battery sector as well as the pigment industry and according to some sources prices are firming. Others however feel that there is a lot of talk about cadmium but are less convinced of prices being much higher, however the bulls have a $1/lb in their sights. Supplies from some sources have tightened up and long gone are the huge stockpiles of material in Russia, but as China, one of the main consumers goes on holiday, but it may be a while yet before the magic number is convincingly achieved. The selenium market remains extremely strong, with the supply squeeze, coupled with good demand from China and elsewhere, driving the market. […]

5) MARKET ROUNDUP – prices remains firm in dull markets

Metal Pages 28/01/05

[…] Antimony has been delegated to the 'back burner' by some traders as consumers continue to resist higher prices and Chinese producers who are reported to hold few stocks remain confident of higher prices after their Spring Festival. Prices remain stable between $3,000 and 3,100/tonne depending on location and quality. Cadmium has risen from its long slumber and prices are rising on good demand from China and India. Bids from China at 75 cents are said to have been received and according to sources 99.99% material is being traded between 75-85 cents whilst 3N5 material is available in a range 10 cents lower at 65-75 cents. Not much action is reported in the selenium market after a busy December but prices remain very firm in a range of about $41-44/lb. […]

6) Cadmium stirs

Metal Pages 10/01/05

The cadmium market is stirring, although there is some debate over whether the activity is a natural market movement or induced by interested parties. The bulls maintain that the market has been more active since the end of last year and that prices have moved up a touch accordingly. Supply has been decreasing on an almost yearly basis and the latest shortfalls to be reported are from the Mexican 3N5 producer IMMSA. "It's a struggle to find 3N5 cadmium," said one major western trader. Other sources point out, however, that demand for the metal remains muted and that any shortfall in supply has failed to convert into big gains for the toxic metal. Said one trader: "Don't get me wrong, the metal has the potential to go up a few cents, particularly if it has some help. However, it's a dull market, dominated by China and India – two countries renowned for their ability to bargain for rock bottom prices. Obviously there is Japan too – and the Japanese will pay a premium for good quality cadmium – but for every tonne they buy the Chinese and Indians buy six or seven." Unsurprisingly, the two parties put the market into two different ranges – the bullish at 75-80 cents/lb for 3N5 and 80-90 cents for 4N and the more bearish at 60-70 and 70-84 cents respectively. The other Mexican producer – Penoles – reportedly has material available and is offering around 70 cents/lb. Meanwhile, European producer Xstrata – which took over Metaleurop's zinc and cadmium operation at Nordenham in Germany – is sold out for 2005, according to sources close to the company. They told Metal-Pages that the company has only 10 tonnes maximum available for the spot market this year, and "that metal may well go if the plant experiences any stoppages". The company is currently producing around 400 tpy – the same as when Metaleurop operated the plant. This material could well go next year if Xstrata is forced, by German environmental considerations, to close the cadmium circuit. At the moment the production just about breaks even. If Xstrata is forced to increase the costs of its cadmium production then the decision to stop it altogether looks inevitable. "At the moment any dollar made on cadmium is good," said the source, who admitted to Metal-Pages that increased costs would make the plant unviable. The source put the market for 4N cadmium around 80 cents. Another 400 tonnes out of global production of 15,800 is not a massive amount. However, if supply dwindles fastest than demand, then cadmium could get the bit between its teeth again. At the moment, though, the best anyone can confidently say is that the cadmium price is unlikely to go down this year. The nickel-cadmium battery is still very much part of the battery sector and is expected to support the market for years to come. But the metal's toxicity and the measures around the world to contain it can only have a negative impact on the market in the long-term. The US Environmental Protection Agency has listed cadmium as one of 11 metals whose use it plans to reduce by 50% this year. In the European Union a proposal is being evaluated to ban all Ni-Cd batteries containing more than 0.002% cadmium beginning January 2008. There is opposition to this initiative, but the road ahead will not be easy for cadmium. At the moment the avenues open for the metal tend to be in the developing countries – China a case in point. Reflecting the increased activity reported by western traders in the last few months of the year, Chinese imports increased by 23.3% to 772 tonnes in November, compared to 626 tonnes the previous month. According to statistics released by China Customs Administration the largest seller, Kazakhstan, doubled its export volume to 251 tonnes, from the 120 tonnes seen in October. Macedonia shipped 174 tonnes to China during the month, against zero shipments in October. The third largest exporter Belgium delivered 147 tonnes, up 177% on the previous month. The increases were offset to a certain extent by zero exports from the Netherlands and Russia in November, compared to exports of around 120 tonnes each in October. Total Chinese imports of cadmium reached 6,265 tonnes January to November, valued at $5.9 million. The figure represents more than a third of total world production. This fact alone will ensure that China remains a powerful influence on the market this year and beyond.

7) Portovesme ISF to close in February

Moneycontrol.com 04/02/05

Glencore will close its 90,000 metric tons-a-year Portovesme Imperial Smelting Furnace in Sardinia, Italy in the second-half of February, company spokeswoman Lotti Grenacher said. The decision to close the smelter has been reached as a result of the "unfavorable economics of the plant and ascended by high coke prices," she added. Discussions are taking place to up production at Portovesme's electorytic zinc refinery, which has a capacity to produce 110,000 tons per year of zinc, Grenacher said. She added that production at Glencore's Portovesme lead plants will continue as normal. Portovesme has struggled with high power costs and was shut from October 2003 until August 2004. The zinc smelter has been operating at 20% capacity due to the power supply problems.

8) Zinifex shares soar

TheAge.com.au 24/01/05

Strong price forecasts for zinc and lead and a solid production performance in 2003 have buoyed investor faith in Zinifex Ltd, the world's second largest zinc producer. The stock closed at new highs on Monday, gaining 10 cents or 3.9 per cent to $2.70. The flurry of interest in Australia's Zinifex - almost 3.5 million shares changed hands during the day - came as the company confirmed it was track to meet its 2004/05 production targets. Earlier, Zinifex gave upbeat price forecasts and said while lead prices were expected to come off the highs from 2004, they should remain above the long term average. Zinc prices in January had been around $1600 per tonne, well above the $1471 mark achieved in the December quarter. Analysts said zinc prices were expected to rise further in 2005, suggesting a strong year for the metal. Zinifex, the company formed out of the assets of the defunct Pasminco, had shown it was operating well, Daiwa Securities resources analyst Mark Pervan said. "People are upgrading zinc prices and this is a positive for Zinifex," Mr Pervan said. "When you get a solid report like this, that helps too. "Given the track record of the stock it's nice to see the company performing well coming into a year of buoyant zinc prices." Zinifex chief executive Greg Gailey said a dip in Zinifex's December quarterly production was more than compensated for by a strong September quarter. "Total production for the first half year remains ahead of the IOM (Institutional Offering Memorandum) forecast," Mr Gailey said. "We are seeing positive signs across the board with zinc concentrate supplies remaining extremely tight and forcing down treatment charges, metal premiums increasing in most of our major markets and continued strong demand for concentrates and diecast alloy from China." Total production for the December quarter was 391,313 tonnes, down slightly on the 397,620 tonne forecast in the IOM. For the first half, total production was 795,091 tonnes, above the 790,837 tonne IOM forecast. Zinifex said sales for the December quarter were strong, reflecting tight markets in both lead and zinc. Zinifex supplies about six per cent of the world's zinc and four per cent of the world's lead metal.

9) Ni-Cd move for battery major

Metal Pages 16/02/05

Leading Indian battery manufacturer Exide Industries will make its first move into nickel-cadmium battery production in the next financial year, it has announced. The Kolkata based company intends to source the required technology from Europe and Japan. Exide is the number one Indian exporter of batteries, delivering to over 40 nations in Africa, Asia, Europe, the Middle East and South America.

10) Can cadmium climb over $1?

Metal Pages 03/02/05

Cadmium prices are firming, supported by continued good demand from the nickel-cadmium battery sector, and steady demand from the pigments industry, particularly in the developing countries. Trade sources put the market for 3N5 at 80-80 cents/lb, with 4N at 90-$1. Cadmium hasn't been near a dollar this century and, according to many pundits, the metal should have been phased out long before now. However, the Ni-Cad battery refuses to die, despite growing global pressure to limit the use of toxic cadmium. If anything, Japanese production of the NiCad has increased, while neighbour China has also increased its cadmium consumption and India continues to buy. Of course, there are moves afoot to replace the NiCad – European producer SCPS has started pre-production of its nickel-zinc battery, designed to help phase out the more polluting nickel-cadmium technology (see separate story). But, for the foreseeable future demand continues steady and supply is declining. Adding to the short-term supply scenario are shortfalls in China. It has been well-chronicled how power shortages and environmental clamp-downs have hit the Zhuzhou zinc and indium smelter. Observers point out that the company also produces around 950 tpy of cadmium. Although it is unclear how much production will be lost, it can only add to the problem created by the zinc concentrates shortage in China. In India trade sources report that prices are at a premium, with one domestic producer declining a bid at 80-90 cents in the West as he can sell in the home market at $1/lb. It maybe too early for cadmium producers to start popping the champagne corks, but cadmium over $1 is looking much more likely than it has for a very long time.

11) Battery maker Saft to add China plant

EeTimes.com 21/01/05

France-based battery supplier Saft has announced it would invest in a new plant in South China to build lithium and nickel-cadmium batteries for the Chinese rail transportation industry. The plant will be housed in an existing building in Zhuhai, Guandong province. Saft will be the sole shareholder of the new Chinese subsidiary. Saft expects the plant to help meet ongoing demand from local rail manufacturers undertaking subway and high-speed train projects in several Chinese cities. "Opening this new manufacturing plant in China is a logical step for Saft," said chief executive John Searle in a statement. "We have shipped more than 20 million cells to China over the last three years and demand is growing for high added-value products such as ours. It is our strategy to manufacture as close to our customers as possible, in order to offer them the best possible service."

12) Chinese cadmium imports climb

Metal Pages 04/02/05

Chinese cadmium metal imports grew 21% in 2004, to an estimated 6,211 tonnes, against 5,119 tonnes in 2003. Waste and scrap imports fell, though, declining 43% to an estimated 938 tonnes, against 1,632 tonnes in 2003. Total cadmium imports rose 6% to an estimated 7,149 tonnes, against 6,752 tonnes in 2003. Kazakhstan supplied the bulk of imports (24%), shipping an estimated 1,511 tonnes of cadmium, up from 662 tonnes in 2003. Macedonia was the next biggest supplier (13%), shipping an estimated 821 tonnes, against zero in 2003. Korea shipped an estimated 676 tonnes, (11%), against 360 tonnes in 2003, the USA 688 tonnes (11%), down from 1,344 tonnes in 2003, Australia 556 tonnes (9%), against 569 tonnes, Russia 482 tonnes (8%), down from 790 tonnes, Mexico 389 tonnes (6%), against 391 tonnes and others 684 tonnes (11%), against 904 tonnes. Since 2001 China has become the world's biggest cadmium importer, with its imports growing eight-fold since 1999.

13) Making porous semiconductors

Physicsweb.org 24/01/05

Scientists in the US have made the first ever aerogel with semiconducting properties. Aerogels are an important class of porous material but most of them are electrically insulating. If the new aerogels can be prepared in thin films, they could be used in photovoltaic, catalysis and sensing applications. Stephanie Brock and colleagues at Wayne State University in Detroit made the aerogels from metal chalcogenides -- compounds that contain a metal and a group VI element such as sulphur or selenium (J Mohanan et al. 2005 Science 307 397). "We have opened up a new class of aerogels," says Brock. "Previously, aerogels were limited to metal oxides and carbon." The useful properties of aerogels are a result of their combination of high surface area, quantum confinement effects and photoluminescence. To prepare the aerogels, Brock and colleagues first made nanoparticles of various metal chalcogenides capped with molecules known as thiolates, which they then oxidized, causing the nanoparticles to form a gel. Next, they dried the gel with supercritical carbon dioxide to maintain the pore architecture. The resulting structures contained pores between 2 and 50 nanometres in diameter. This means that the materials have surface areas as high as 250 square metres per gram. Moreover, the cadmium sulphide aerogel had a bulk density of 0.07 grams per cubic centimetre, which is just 1.4% of the density of a single crystal of cadmium sulphide. The Wayne State team also used the technique to make aerogels with cadmium selenide, zinc sulphide and lead sulphide. "Finding ways to assemble nanoparticles into actual functional devices -- without losing the characteristic nanoscale properties -- is one of the current challenges for nanotechnology," says Brock. "This 'sol-gel' route provides a simple, versatile method to do this, and should be amenable for the creation of more complex composite materials too."

14) Nanoscopic Lamps

Chemie.de 02/02/05

Miniaturization is finding its way into diagnostics and bioanalysis. Miniature-scale systems, such as DNA chips and labs in credit-card form have been in use for some time. Swiss researchers have now developed a new kind of lamp for use in nanoscopic methods. At the core of the new device are nanocrystals made of semiconducting materials. The research team headed by Horst Vogel at the Swiss Federal Institute of Technology in Lausanne (EPFL) selected green-fluorescing crystals of cadmium selenide, which they coated with a thin layer of lipid molecules like those found in cell membranes. The lipid layer protects the nanocrystals from exterior influences and makes them water-soluble without impeding their fluorescence. The lipid layers also have a particular advantage compared to other coatings -- they can easily be equipped with biochemical functions. In order to test the potential of their concept, the EPFL team equipped the coated crystals with two different types of molecular "hooks", which each specifically bind only one type of "eye". The scientists "printed" a two-dimensional microscopic pattern of special protein complexes onto a glass plate. These complexes carry the eyes (the protein streptavidin) that correspond to the first type of hook (the vitamin biotin). The luminescent crystals then bind selectively to the printed pattern. "Our tiny lamps can also be incorporated into defined structures relatively easily and with micrometer precision," says Vogel, " which is necessary for analysis with DNA or protein chips." This is where the second hook (nitrilotriacetic acid) comes into play; it can be used to "fish" for marked analytical molecules. As an example, the researchers placed a red fluorescing protein that carries the appropriate eye (hexahistidine) on the glass plate. The protein immediately bonded to the crystal. When the luminescent crystals were then irradiated with light of a certain wavelength, they entered an excited state. Normally, they would re-emit this energy as green fluorescence; instead, the "nanolamps" transfer their energy packets directly onto the attached proteins. This energy is exactly what the proteins need to get excited themselves. As they return to their ground state, the proteins emit this energy as red fluorescence, which can be detected. The crucial trick is this: the radiation-free energy transfer from a nanolamp to the proteins only occurs when the distance between them is less than 10 nm. "Only specifically bound proteins are thus made to fluoresce," says Vogel, "such a high sensitivity can not be attained with conventional light sources."

15) Hard X-Ray telescope up for final NASA review; project will be led by Caltech's Fiona Harrison

California Institute of Technology (caltech.edu) 05/02/05

If all goes well with a technical study approved by NASA for this year, an innovative telescope should be orbiting Earth by the end of the decade and taking the first focused high-energy X-ray pictures of matter falling into black holes and shooting out of exploding stars. Not only will the telescope be 1,000 times more capable of finding new black holes than anything previously launched into space, but it will also give us an unprecedented look at the origins of the heavy elements we're all made of. Named the Nuclear Spectroscopic Telescope Array--or NuSTAR, for short--the project has just been pegged by NASA for detailed study in the competitive Small Explorer Program (SMEX), which seeks out new technologies and new proposals for space missions that can be launched at low cost. NASA announced earlier this week that an unrelated mission called the Interstellar Boundary Explorer will be launched by 2008, and that NuSTAR will be given an up-or-down decision by next year for launch in 2009. According to California Institute of Technology astrophysicist Fiona Harrison, the principal investigator of the NuSTAR project, an April high-altitude balloon flight in New Mexico should help to demonstrate whether the advanced sensors invented and built at Caltech are ready for space. The balloon phase of the project sports the intuitive acronym HEFT (for High-Energy Focusing Telescope), and will mark the first time that focused pictures at "hard X-ray" wavelengths will have been returned from high altitudes. In fact, the HEFT data from the balloon is expected to be superior to any data returned so far from satellites at high X-ray energies. NuSTAR will be much better than the balloon experiment, Harrison explains, because it's necessary to get above Earth's atmosphere for extended periods to get a good view of the X-ray sky. NuSTAR will orbit Earth at an altitude of about 300 miles or so for at least three years. The reason that the new technology will be superior to that employed by existing X-ray satellites for certain observations is that high-energy, or hard, X rays, tend to penetrate the gas and dust of galaxies much better than the soft X rays observed by NuSTAR's forerunners. Thus, NuSTAR will get the first focused hard X-ray images for three basic science goals:

- The taking of a census of black holes at all scales. NuSTAR will not only count them, but will also measure the "accretion rate" at which material has fallen into them over time, and the rate supermassive black holes have grown.
- The detecting and measuring of radioactive stuff in recently exploded stars. These remnants of supernovae will provide a better idea of how elements are formed in supernova explosions and then mixed in the interstellar medium, which is the space between stars. NuSTAR will be especially good at observing the decay of titanium to calcium, which tends to be produced in the region of a supernova where material either is ejected forever from the explosion or falls back inward to form a compact remnant of some sort. NuSTAR will thus be an especially good probe of this region, and the data returned will contribute directly to NASA's "Cycles of Matter and Energy" program.
- The observing and imaging of the highly energetic jets that stream out of certain black holes at nearly the speed of light. Coupled with observations from the Gamma-Ray Large-Area Space Telescope (GLAST), NuSTAR will provide data to help scientists explain this still-enigmatic but powerful phenomenon.

The technical difficulties of obtaining hard X-ray images has been overcome with groundbreaking work in various Caltech labs, including that of famed inventor Carver Mead, who is the Moore Professor of Engineering and Applied Science, Emeritus, at Caltech. Both HEFT and NuSTAR will rely on an array of coaligned conical mirrors that will focus X rays from about 20 to 100 kilo-electron-volts on a pixel detector made of cadmium zinc telluride. The sensor is segmented into squares of about half a millimeter each, and these will take thousands of individual readings of X-ray photons and turn them into electronic signals. "With this mission, we'll open the hard X-ray frontier and look at things never seen before," says Harrison, who is an associate professor of physics and astronomy at Caltech. In addition to Caltech, the other participating organizations and universities are the Jet Propulsion Laboratory (managed by Caltech for NASA), Columbia University, the Stanford Linear Accelerator (SLAC), the Lawrence Livermore National Laboratory, Sonoma State University, the University of California at Santa Cruz, and the Danish Space

Research Institute. NuSTAR's mast will be built by ABLE Engineering and the spacecraft will be built by General Dynamics Spectrum Astro.

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