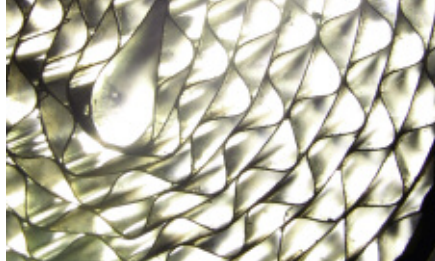


200 Dollars per Gram

The Metal that Makes Truffles Seem a Bargain

By Wolfgang Wrzesniok-Rossbach, Head of Sales & Marketing, Heraeus Metallhandelgesellschaft m.b.H.

Imagine that tonight during dinner, you take your family or your friends on a little adventure. For that you won't have to travel very far – just look underneath your dinner table. And imagine that there's a big silvery-white cube sitting there, filling up the space. What you might see there is all the rhodium that is produced in one year, a little less than two cubic meters (or not even 70 ft³). You don't have to worry, by the way, that the metal might melt away from its hiding place under your table. Rhodium has a melting point of 1,966C (3,571F) and it boils at 3,727C (6,741F) – a little higher than the water usually used for the after-dinner espresso.



In catalytic converters like that pictured, rhodium turns the polluting nitrogen oxides responsible for acid rain into inert nitrogen. Tighter emission laws, together with increased industrial use, have helped drive the metal's price back up to its 1990 all-time high near \$7,000 an ounce.

Size and heat resistance are one thing; value is another. And here you can really amaze your fellow diners, because the 'little' cube would have a market value of \$4.6 billion. Of all eight precious metals, rhodium is by far the most expensive – almost ten times as costly as gold and worth five times the price of platinum, the second most expensive precious metal.

That hasn't always been the case in the 203 years since the metal was officially discovered by the English scientist William Hyde Wollaston, using for his findings platinum ore that he presumably obtained from South America. The origin of the name comes from the Greek word 'rhodon', meaning 'rose'.

Rare – and Never Alone

There are no completely reliable long-term production figures for rhodium available, but approximately 425 tonnes of it have probably been unearthed in the last 200 years: 300 in South Africa, 100 in Russia and the remainder in several other countries, mainly in the Americas and in Zimbabwe.

As in the case of its sister metals, ruthenium and iridium, there are no primary deposits of rhodium in existence. The metal is always contained as a by-product in platinum-bearing ores and can be found also in certain nickel deposits. Global supply has risen 50 percent in the last ten years, mainly as a result of a doubling in South African production. Today the four major South African platinum metals producers account for 85 percent of the global production of nearly 26 tonnes (around 825,000 ounces), while Russia has a market share of around 12 percent. Russian supply has shrunk on average during recent years, mainly due to reduced stock sales, but this development has been more than counterbalanced by the above-mentioned production increase in the South African Bushveld.

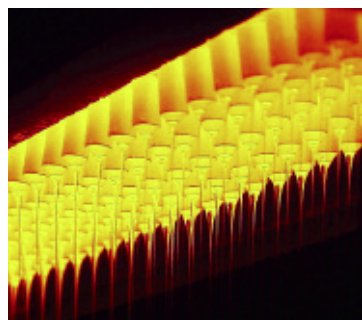
Whether that will be enough to counter the so far ever-increasing industrial demand remains to be seen. However, what is already apparent is the importance of the metal for South African mineral exports. At current market prices rhodium exports are valued at about \$4.1 billion. That is two-thirds of the total value of the South African gold exports, but who – apart from a small group of insiders – has ever heard of a chemical element called rhodium that is set to challenge the importance of the yellow metal as a major export earner for the Rainbow Nation?

Thanks to South Africa's mineral richness, the world is not going to run out of stocks of rhodium – nor any of the other platinum

Different types of catalytic converters are used for cleaning harmful exhaust pollutants. As well as automobiles, their use has now spread to motorcycles, lawn mowers – and even chainsaws.



group metals – for the foreseeable future. There are estimated reserves of 3,000 tonnes of rhodium still in the ground, waiting to be unearthed. Unlike in the very early years, when the ore deposits were easily accessible, it now takes a little more effort to get the metal out of the ground. With underground mines between only a few hundred metres and a maximum of 2,200 metres deep, the challenges for South Africa’s platinum producers are in fact comparable to the ones that its gold industry is facing, which currently plans expansion that will lead to depths of more than 4,000 metres.



Bushings for the production of glass fibre that contain rhodium. The metal is needed to increase the durability of the platinum-based equipment.

An Indispensable Element

The efforts the South African mining industry are undertaking are probably worth it, as some industries are waiting desperately for an increase in supply to bring prices down, or at least to enable them to not have to live from hand to mouth as far as metal availability is concerned.

The major user of the white metal has remained unchanged for the past 30 years: it has been the automobile industry, ever since the metal was introduced into catalytic converters of cars because of its ability to turn nitrogen oxides – responsible for the acid rain so widely discussed during the 1980s – into harmless nitrogen.

With its share of nearly 870,000 ounces, more rhodium is used by the automobile industry than it is actually newly mined. The resulting gap between fresh supply and that high demand is filled by an increasing recycling quota that accounts for every fifth ounce of rhodium that is employed in car catalysis. Ten years ago, the share of metal coming from the recycling of scrapped catalytic converters was only half of today’s percentage rate, and – as the amount of metal used then was considerable lower – only a fourth of the absolute number of ounces.

Of course there have been as many attempts to reduce the rhodium loadings in car catalysis

as there were different engine models. But so far any successes in that field have always been neutralised in the medium term by another change in legislation, which required yet again a higher metal loading in order to fulfil the tightened limits. That is exactly what happened in Europe after the introduction of EURO 4 emission standards in 2005 (and comparable regulations in other countries). But now for the first time it looks as though the next level in emission standards, EURO 5, might not bring consumption back up to the old levels. EURO 5 will become mandatory for all new car models in September 2009, and for all new cars in January 2011.

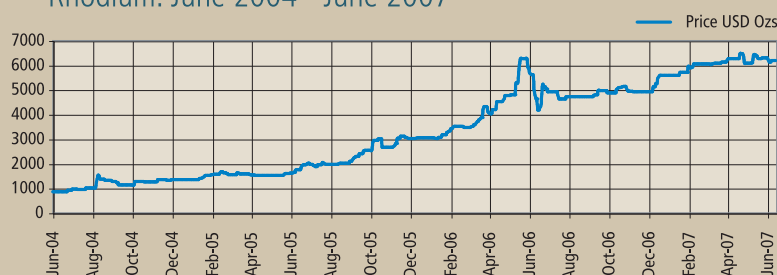


Deep-level mining of pgms on South Africa’s Bushveld Igneous Complex presents many challenges. The relative density of the host rock is greater than that generally associated with gold mines on the Witwatersrand complex, so rock pressures and associated seismicity increase with depth at a higher rate. Ambient mining temperatures also increase much faster. *Photo courtesy Northam Platinum Limited; all other photos courtesy Heraeus*

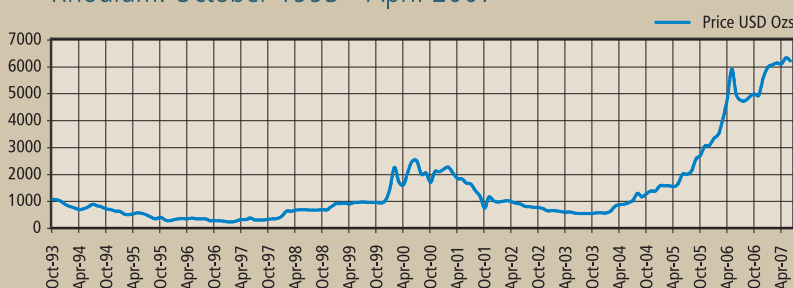
Falling consumption in the automobile industry would be good news for the two other main industrial end-users of rhodium, namely the chemical and glass industries. The latter uses rhodium, alloyed with platinum, for the production of high-quality glass. The build-up of new production facilities for flat-panel display glass in Asia has kept annual demand from that sector between 1.5 and two tonnes for the last three years, and a few more expansion projects have already been announced. Nonetheless, the demand for platinum and rhodium from that sector might have seen its peak in 2006, and is likely to fall back again during the coming years to the long-term average of one tonne per year.

Apart from flat-screen glass production, rhodium (in combination with platinum) is also used to manufacture fibreglass. Here the metal is used in bushings, nozzles and spinnerets. Unlike in the car industry and

Rhodium: June 2004 - June 2007



Rhodium: October 1993 - April 2007





Gauze made of a platinum/rhodium alloy, used to produce nitric acid for the fertiliser industry.

some parts of the chemical industry, rhodium is not continually consumed in the glass sector. Instead it is kept in a closed loop – when a second set of metal is needed for the manufacturing of new equipment prior to the recycling time of the old one, it is usually borrowed rather than purchased.

Nearly 1.5 tonnes of rhodium per year end up in the chemical industry. Here the metal is used in catalysts for the production of oxo alcohols and acetic acid. Producers of fertiliser are also frequent users of rhodium, where it is used, again in combination with platinum, for gauzes, which act as a catalyst for the formation of nitric acid through ammonia oxidation.

One of the earliest uses of rhodium – the electroplating of white gold and platinum jewellery in order to give these metals a reflective white surface – today has a largely negligible influence on the demand side.

Trading the Untradable

At first glance rhodium trading does not appear overly complicated. There are no exchange traded futures, no ETFs, no options (let alone any exotic ones), no interest rate derivatives and no fixings. The full product range consists of spot trades and forwards (usually out to 12 months, with very few examples of trades beyond that threshold). And then there are leases, usually used by the glass and chemical industries. Bridge loans are found frequently in both sectors, when a manufacturer temporarily needs more metal to be able to exchange parts of the production equipment. At times, leases are also used to finance the entire metal inventory.

In the past, some companies have done sale and leasebacks of their precious metal inventory. But what works for platinum and palladium is a different animal in the case of rhodium. Interest rates of currently over 30 percent on the offer side (and 20 on the bid side) and a basis price for the lease-fee calculations well above \$6,000 an ounce are

without doubt hurting, and clearly call into question any decision to lease metal instead of buying it.

Spreads are not only wide when it comes to leases – the same is also true for spot trades. On top of that, the market can be very illiquid, and more than once it has seemed impossible to find any sellers when the price is rising, or to find buyers at acceptable prices when the value of rhodium starts diving.

Hedging activity in this market by using forwards is rather limited. From time to time there are trades entered into by car manufacturers. There has been also some forward selling by producers, at least in past years.

Trades are settled usually on weight accounts at one of the leading precious metal fabricators. Whenever possible, physical transport is avoided, but if that takes place, the metal is usually delivered in the form of either powder or sponge, not in solid form.

The Unfiltered Truth: Prices Fluctuate between \$200 and \$7,000 per Ounce

The normally dirty grey, dusty appearance of industrial-quality rhodium powder stands in sharp contrast to the extreme value of the metal. Long gone are the decades when the price of rhodium was more or less stable at \$200 an ounce. After an initial price peak in the late 1970s and a long stable period with prices around \$1,200 in the 1980s, the metal's value gained dramatically in 1990, rising to nearly \$7,000 an ounce on the back of an announcement of problems at Rustenburg Platinum's precious metals refinery.

On top of a situation of already tight availability, reports reached the market that the US Department of Defense was planning to acquire the metal for the national stockpile, a fact that contributed further to the rise. In the middle of 1991 prices started to come off again, when additional Russian deliveries reached the market and Nissan announced that it had developed a rhodium-free catalytic converter. By the end of that year the price had come off to \$1,850 again. And that was not the end of the decline: a few years later, at the beginning of 1997, the metal even reached \$200 per ounce again, the lowest level since the early 1970s. Continuing sales of Russian material, investors bailing out of speculative long positions and an absence of industrial buyers, which were partly using up inventory that had been built up during the 1990 rally, all contributed to the downturn.

Ten years after the metal reached its all-time high, the market jumped back above \$2,500 an ounce. This time strong demand from Asia,

a lack of physical availability and speculative buying on the back of the palladium price explosion caused the spike, which was followed over the next few years by yet another steep decline, bringing the value down again to just below \$500. Since January 2004, a combination of tighter emission laws, additional demand by the glass and the chemical industries and – last but not least – speculative buying interest caused another tremendous price spike that brought the metal's value almost back to the 1990 all-time high.

And on a short-term basis there is no relief in sight: because of the high prices, the car industry is still reluctant to enter into any new hedge positions, hence causing a lack of liquidity supply on the lease market and, as a result, higher interest rates. These then force borrowers to buy the metal instead of continuing to lease it in order to limit the interest-rate risks they are facing.

In the long run, current market conditions will not last. Lower demand for some applications, rising supply from primary as well as secondary sources and profit taking by investors might all come to the rescue of the beleaguered end-users. The mining industry – at the moment profiting massively from the high prices – might not be too sad about a limited decline of the price either. After all, it would put their clients at ease and slow down the massive determination to substitute as much of the expensive metal as possible.

All things considered, the rhodium market has all the ingredients for an exciting future. And until we all drive home from dinner (remember to have a look underneath your table first) in either diesel- or fuel-cell-powered cars – both of which require no rhodium – prices of \$200 per ounce will remain a distant end-user's dream. ■



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