

OPINIONS & COMMENTS

Platinum group metals keep new cars on road

By LES C. VINNEY
Group vice president,
Performance metals—
Engineered Materials division
Engelhard Corp.

The following is the first of two excerpts from remarks delivered at the Capital Metals and Materials Forum in Washington on May 25. The forum was sponsored by the Bureau of Mines and the Department of the Treasury.

The increased use of platinum group metals (PGMs) in this decade makes it clear that their role in industrial production is growing in importance. At Engelhard Corp., we are actively involved in many of the technologies contributing to that expansion—from environmental catalysts to applications vital to our national defense.

Simply listing the ways these industries use platinum group metals, however, is far from the whole story. It is their significance to the consumer, in terms of quality of life, that is a key issue in today's changing world.

It has been estimated that one of every five products we use today is either made out of platinum or platinum was used at some point in its production. If you include platinum's sister metals, the number of products might even be one of four.

Despite this universality, platinum group metals have a low profile in today's world. The recent excitement over "cold fusion" has generated some newfound attention for platinum and palladium, in particular. But compared with other raw materials—such as wood, copper, tin, and aluminum—PGMs are not as obvious when it comes to the role they play in our everyday lives. Except for their use in jewelry and some decorative applications, they are virtually invisible to the consumer.

Role of PGMs

I would like to suggest that we take a step back and take a look at the role PGMs play in our everyday lives. Let us take some specific, clear-cut examples.

The automobile has become one of the most basic and essential elements in our lives. Even if you live in the Washington, D.C., area and take the Metro to work, when you go home, it is probably your car which takes you shopping, to church or synagogue, to the movies or on vacation. The car is both the core and the symbol of something we routinely take for granted: our mobility.

What would happen if we removed from that car everything made of PGMs or that was made from a process employing PGMs at some stage? Well, let's see...automobiles have five basic systems: fuel, lubricating, cooling, elec-

trical and emissions control.

Obviously, the catalytic converter would be one of the first components to go. I mention it first because this single application consumes about four times as much platinum as all chemical and petroleum applications combined.

The platinum catalyst reduces the carbon monoxide and hydrocarbons resulting from the combustion process and is particularly important in its resistance to lead. Small amounts of rhodium reduce nitrous oxides.

Palladium and its alloys may become a more widely used alternative in the few industrialized countries, such as the U.S. and Japan, where the gasoline supply is virtually lead-free. But because of its superior resistance to lead, platinum will remain important to auto catalysts well into the next century. With this first example, bear in mind: Precious metals offer specific catalytic performance 100 times better than base metals, such as nickel.

Next is your car's engine. It's made of steel, which is primarily made of iron ore. That ore was mined with explosives, which were more than likely made from nitric acid. Nitric acid is made from a process involving the combustion of ammonia and water over platinum gauze—the key component that makes the production of nitric acid cost effective. The steel itself was produced in a process controlled using thermocouples composed of platinum wire and accessories.

Even if the engine was still there, it wouldn't run—at least not efficiently—on the gasoline that would be in the gas tank. Refining and reforming catalysts made with the help of PGMs produce the high-octane gasoline that powers today's automobile engines.

As a matter of fact, you also can toss out the entire lubricating system. Platinum-based catalysts work their unique magic in the refining process that produces your motor oil. And while you're at it, pull out the entire cooling system. The coolant was produced with the help of PGM catalysts, as well. In addition, many of the circuits that control your air conditioning and heating systems are composed of PGM alloy components that keep them working, despite severe operating conditions.

Electrical system

Just about all your car's electrical system has to go, too. Some modern cars have up to 1,000 capacitors; these and most of the micro-processor controls in your electrical system use PGM alloys because they're more reliable than other metals. The electronics in your AM/FM stereo radio, your cellular phone and also your electronic ignition include

PGMs, either printed or plated or fastened on, so you'll have to scrap them too.

Now you can start looking for all the rubber in your car. Not just the tires, but the gaskets around the windows, the engine mounts and the hundreds of other places where rubber is used. Chemical intermediates containing PGM catalysts went into making that rubber, so it has to go too.

Say good-bye to the windshield and all the window glass. Plus the headlights, all the lightbulbs in the dashboard—don't forget the one in the glove compartment—and anything else in the car made of glass. Glass makers use a variety of equipment and temperature sensing devices made of PGMs because of their ability to function properly despite the high temperatures and corrosive environment of the glass manufacturing process.

Next to go is all the trim: the grill, door handles, wheel covers and decorative strips. Modern electroplating processes employ PGM coatings on titanium anodes to produce chrome trim with greater corrosion resistance and longer life—all at lower cost and with no contamination to the process or the environment.

The fabric in your car? It has to go. If it's man-made, PGMs were used to make it. Even if it's not man-made, it was undoubtedly treated with chemicals that, somewhere along the line, were exposed to PGM catalysis.

You can say goodbye to the paint as well. Paint manufacturers use PGM catalysts as chemical intermediates. In fact, without the unique catalytic capabilities of PGMs, today's automobile paint would not be as easy to apply, look as good or last as long.

Steel needs PGMs

Well, at least you still have the body of your car, right? Wrong! Everything in your car made of steel has to go: the chassis, frame, doors, hood, trunk lid and fenders. As previously described, steel-making depends on PGMs.

Aha, you say. Your car has a plastic body. Sorry, but it goes too. It's a fiberglass-reinforced plastic body, made with the help of platinum bushings that do not warp or deform despite the high temperatures involved in the manufacturing process for fiberglass. In fact, you can remove everything else in your car made of plastics, even if it isn't fiberglass-reinforced. Either the catalytic effect of PGMs or their ability to function in hostile chemical or high-temperature environments contributed to their manufacture.

If you haven't guessed by now, your car—at least the car you drive today—couldn't exist without platinum group metals. There might be something else in your driveway—a Stanley Steamer—but unless you are an antique car aficionado, you probably wouldn't enjoy driving it, and it probably would still cost you \$20,000.

OPINIONS & COMMENTS

Life would be tough without PGMs

By LES C. VINNEY
Group vice president,
Performance metals
Engineered Materials division
Engelhard Corp.

The following is the second and final excerpt from remarks delivered at the Capital Metals and Materials Forum in Washington on May 25. The forum was sponsored by the Bureau of Mines and the Department of the Treasury.

Now let's take a look at the second area in which platinum group metals play an important role: your home. What wouldn't be there—at least in its current form—if PGMs didn't exist?

If I came to your home to visit you, the first thing I probably would notice is that your lawn isn't as green as usual. The nitrogen fertilizer you normally use to maintain a lush, green lawn would most likely be too expensive if it had to be made without the benefit of platinum gauze.

The next thing I probably would notice is the absence of aluminum siding. Of course, the same nitric acid that ended up as fertilizer also is used to manufacture the explosives that get aluminum ore out of the ground.

When you show me in, I can't help but notice that your wall-to-wall carpet is gone. Nitric acid also was used to manufacture its fibers.

A barren wall is where your home entertainment center used to be. The TV set is gone because its glass picture tube was manufactured using process hardware and temperature sensors made of PGMs. Its capacitors and printed circuits, like those we threw out of your car, also were made with PGMs. Your audio equipment is gone for the same reason.

I won't ask where your microwave oven is; I know that with the technology made possible by the distinctive properties of PGMs, the microwave probably would not have been invented.

In fact, all the modern appliances I'd find in your kitchen—the food processor, coffee maker, toaster oven—they all exist

based on technology reliant upon PGMs. Yes, I guess you still could cook without them, but would you remember how?

Now let's look at another area where PGMs have a major impact: lifestyle. The food, clothing and leisure-time activities we enjoy so much. Clearly, you wouldn't go hungry. But fertilizers produced employing PGM catalysis make up about 40 percent of all the fertilizers used to increase crop yields. Without the platinum gauze that makes production of nitric acid cost effective, crop yields would be lower and the price of food higher.

But cost is only one of the factors influenced by the use of PGMs. Many preservatives that keep foods fresh and prolong shelf life are made with intermediates that rely on PGMs and their catalytic capabilities.

Convenience is another lifestyle component. The food-processing industry relies heavily on PGM-based temperature sensors and electronic systems in dehydration, blending, quick-freezing, packaging, even shipping food products to the marketplace and storing them prior to sale.

What about our clothing? Man-made fibers are made by a series of processes that depend in part on the special properties of PGMs. The bleaching, dyeing and weaving of the fabric is made easier and faster because of PGMs.

Leisure-time activities also are influenced by PGMs. Platinum bushings play a major role in the methods used to produce our plastic sailboats and power boats, our surfboards and fishing rods and reels. Camera lenses are made with the help of PGMs, so is the film. Video cameras and videotape are end products of manufacturing processes that employ PGMs at some stage.

The final area in which PGMs play a key role involves the world around us, the earth and sea beneath us, the air we breathe and the sky above us.

Motion sensors, made with platinum, detect earthquakes and the motion of bridges. Environmental catalysts made with PGMs reduce pollutants from industrial processing plants. Electronic sys-

tems made with PGMs help our ships navigate and guide our jet planes to their destinations.

Our defense systems are heavily reliant on PGMs. Communication satellites can't operate without them. Without PGM-based composites, capacitors and semiconductors, our astronauts couldn't function in space. Space stations orbiting the earth and expeditions to other planets will need the magic of the six platinum group metals to reach their goals.

Finally, one of our most vital concerns—our health and that of our loved ones—is greatly dependent on PGMs. Electronic circuitry made with the help of PGMs monitors the heartbeats of our newborn children. The probes on diagnostic devices that help doctors find out what ails us would be far less reliable without PGMs. Pacemakers and hearing aid implants wouldn't exist. Neither would many of the drugs that stop cancer cells from multiplying.

I have given you many examples of how the special properties of platinum group metals—their resistance to corrosion, their ability to function at high temperatures and under high-stress conditions and their catalytic capabilities—allow them to serve us in ways other metals cannot.

PGMs offer us the clearly better alternative between today's automobile and the Stanley Steamer; a modern home and a log cabin; our cellular phones and the pony express. Furthermore, by enabling us to enjoy the technology and capability of today's computers, PGMs give us the opportunity for the technological extension of our minds in contrast to the dreams of the science fiction writer. As our horizons expand, PGMs extend the limits of our world from the boundaries of the earth to the expanse of the universe.

No matter how good your imagination, no matter how creative your mind, it is impossible to imagine a world without platinum group metals. And, even if we could imagine it, no one would be willing to go back to it.

OPINIONS & COMMENTS

Supply-demand figures put sheen on platinum

By NEIL CARSON
Marketing Manager, N.A.
Johnson Matthey Plc

The following is the first of two excerpts from remarks Mr. Carson delivered at the Capital Metals and Materials Forum on May 25 in Washington. The forum was sponsored by the Department of the Treasury and the Bureau of Mines.

To open up my discussion on platinum, I would like to make a quick comparison with another commodity—gold.

Each year around 1,500 tons of gold are supplied to the Western World. Consumption of gold is divided into industrial demand, jewelry and, of course, investment. And of this investment sector, in 1987 just over 200 tons of gold were made into official gold coinage.

If we now talk about platinum, the total supply to the Western World in 1988—which was a record year—was only just over 100 tons; one-half the size of the gold coin market. Overall, the platinum market is one-fifteenth the size of the gold market.

As you will be able to appreciate then, the platinum market is small. However, if you were to survey the commodities pages of newspapers around the world, you may be forgiven for thinking the platinum market gets more than its fair share of comment in relation to the size of the market. In fact, even if you have no professional interest in this white metal, it would have been difficult to avoid hearing something about platinum and its applications at some stage during 1988.

The major reason behind this additional press coverage is that platinum has a very interesting and exciting story associated with it at present.

For example, things were far from dull with the price. Platinum entered 1988 at around the \$500 level and, on the back of bearish sentiment for gold and the threat of an industrial slowdown, the price actually fell toward \$440 per ounce in February, where it briefly reached a parity with gold for the first time since late 1985.

Record levels of demand at these levels then steadily boosted the price from \$440 to a peak of \$655 on June 1, while gold remained in the \$430-\$450 range.

Perhaps it was a lack of interest in these higher prices that caused a brief dip back to \$500 in September when a rebound sent the price into a period of several months in the upper \$500s once more.

At this point in early December we were all confident the price would remain at the \$580 level or even firm a little into the new year. Our confidence was based on the fact that demand for the metal had reached record-high levels,

and although supply was set to rise in future years, it was lagging dramatically behind current demand, even though the mines were working at full capacity.

Then came an announcement by Ford that it had developed an auto catalyst that did not require platinum.

The market fell close to \$100 per ounce in a week, recovering slightly to end 1988 at \$520 per ounce, a \$20 premium on its first January level, a true roller-coaster ride fairly typical of this market.

My talk today aims at presenting Johnson Matthey's recently finalized figures for the supply and demand of the platinum group metals in 1988. Finally, I will attempt some crystal-ball gazing and make some projections about the price in the near term. But first, the bottom line—the supply and demand balance in 1988.

Both supply and demand set all-time records in 1988.

Supply increased 3 percent to 3.2 million troy ounces, while demand rose 10 percent to 3.66 million ounces. The impressive increase in demand is even more impressive when we consider that this 10 percent increase comes on top of a 15 percent increase in the previous year. In fact, in 1983 demand was only at 2.2 million ounces, or less than two-thirds of 1988's number.

So what has happened to boost consumption for this white metal so dramatically?

The three biggest areas of demand are the auto catalyst area, the jewelry sector and small investment demand. Together these are responsible for more than 75 percent of Western World demand.

The auto catalyst sector is obviously a cornerstone of the demand equation.

In 1970 the U.S. Clean Air Act laid down the first stages of the continually developing legislation that was to control emissions from car exhausts. Later that decade the Japanese followed suit, with the result that these countries have been the pacesetters in this industry. The realization has been in place, led by places like California, that exhaust emissions damage our quality of life and our environment. In Europe, because of the fractured nature of the marketplace, they have been slower in unifying their attempts to control emissions. However, they recently have got their act together and legislation is slated to become law progressively between now and 1993.

The change in attitude in Europe has been noticeable and swift. Just a matter of months ago you were considered eccentric by most if you talked in public about saving the environment, acid rain or ozone. In Britain especially it was not a concern as any air-borne pollution caused on the island was blown quickly northeast and became Scandinavia's problem.

Following four of the hottest summers

on record, the voter is starting to get concerned generally about the environment. Global warming, ozone and pollution suddenly are acceptable subjects, and the politicians are, as ever, quick to jump upon the bandwagon.

The result has been that, while Europe until recently has been rather recalcitrant about this issue, developments of the past couple of months have been spectacular.

Recent proposals by the European Parliament, if accepted, would impose U.S.-type standards on Europeans. Perhaps most significant would be the small-car legislation, which would mean a good proportion of cars under 1.4 liters would need catalysts. In Europe more than half the cars purchased fall into this category.

Since 1969, in the early days of the development of the auto catalyst, the scientists within the car companies and their suppliers have continually been experimenting with combinations of catalysts that would optimize the use of precious metals. The precious metals in their "tool box" in that time have been mainly platinum, palladium and rhodium.

Over the years, one combination has emerged as by far the most successful and widely used in this application and this is the platinum-rhodium, so-called three-way catalyst. There are several reasons for this, and Johnson Matthey feels that it will continue to be the case in the foreseeable future.

Petroleum around the world contains substances that tend to "poison" a catalyst. One of the biggest enemies of this type of catalyst is lead, and the United States and Japan have taken steps to remove this element from their gas. Other contaminants are sulfur and phosphorus.

Platinum is the element most resistant to attack from these poisons, and this is one of the major reasons it has been selected as the catalyst of choice, especially in Europe, where residual lead in petroleum is likely to be a significant factor for many years to come.

Another significant factor is operating temperature. The general trend in automobile engines is to engineer smaller but more powerful power units. This trend tends to push up the operating temperature of the engine, and platinum is a better catalyst than its rivals at the higher operating temperatures.

Other trends are toward tighter emission regulations and better durability for catalysts. Both of these factors tend to influence manufacturers toward platinum and away from alternatives. In many ways, platinum is perhaps a safer option for the car producer in that if he selects a catalyst that only just passes the emissions tests but then in actual operation is found to be lacking, there is the possibility that a recall of cars will be necessary at vast expense. These considerations must all be weighed in the balance when decisions on catalyst composition are taken.

PLATINUM

Platinum is one of the precious metals. Native platinum occurs as grains and scales usually in stream placers associated with areas of basic rocks such as dunites. The platinum is so thinly scattered in the original host rocks that in only a few places in the world does it pay to mine it. Nearly all of the world's production comes from stream or beach placers. Platinum has a specific gravity of from 14 to 19 depending on impurities, a hardness of 4 to 4.5, and a whitish steel-gray color and streak. Iron is commonly alloyed with platinum, imparting the magnetic quality displayed by nearly all samples. Other metals alloyed with platinum include iridium, rhodium, palladium, and osmium. Platinum can be distinguished by its color, malleability, high specific gravity, infusibility, and insolubility. It is soluble only in heated aqua regia.

In Oregon, platinum is found associated with the "black sands" along the southern coast and in streams draining the Klamath-Siskiyou mountains area. Much platinum was thrown away by early prospectors who failed to recognize it when they operated their gold placers.

Platinum is extensively used in jewelry, commanding a higher price even than gold. In industry, platinum-tipped electrical contacts are practically standard, having a much greater life than other metals. Platinum catalysts help produce high-octane gasolines, and the metal is extensively used in laboratory ware because of its high melting point and resistance to chemicals. Some cigarette lighters use platinum sponge catalysts to ignite the fuel.

World production of platinum comes principally from the Soviet Union, Canada, and South Africa. Colombia and the United States produce only minor amounts.