Maximizing returns from precious metal bearing catalysts - your refiner holds the keys

Ronald Bleggi
Senior Vice President of Finance
Sabin Metal Corp., East Hampton, NY

1. Introduction

Wildly escalating values of PGMs - particularly the platinum and palladium used in catalytic processes and pollution abatement applications - have increased costs significantly for many users. As prices for PGMs rise, recovery/refining processing turnaround time increase, and lease rates move up, you have the makings of a classic profit squeeze. While any one of these factors will decrease profits, the combination of all three can have a dramatically negative effect. At one point this year for example, palladium prices were as high as $1100 an ounce; while platinum prices reached a high of $650 an ounce. (In most cases lease rates are directly influenced by supply and demand but they also can impact precious metals prices which will be explained later.) At those values PGM users are forced to seek relief in a number of different directions. Since you are not likely to influence metal market prices, the next and best place to turn is to your precious metals refiner. The refiner, at least, has some control over precious metals management, certainly as far as your returns are concerned. At the refiner, there are three critical factors associated with maximizing returns from virtually all precious metal bearing materials. These are sampling, assaying, and processing turnaround time. We'll provide a brief overview of each of these areas below.

2. Precious metals sampling

To accurately determine the amount of precious metals present in materials for recovery three different sampling techniques are used. These are dry sampling, melt sampling, and solution sampling. Each of these techniques offers specific advantages; determining the best one to use depends upon the type of material being processed as well as its estimated precious metals content.

Fundamentally, the principle of sampling involves "reducing" large quantities of precious metal bearing material (as much as many tons) into small quantities (as little as a few grams). Samples are then extracted for analysis from different fractions and/or different stages of the resultant sub-lot. The sampling procedure begins by converting precious metal bearing scrap materials into a homogeneous mass so that molecules of precious metals and other constituents are evenly distributed. Results of sampling the homogeneous mass thus represent an accurate ratio of the precious metals content in the overall matrix.
Melt sampling

In melt sampling, a carrier metal such as copper is melted along with the precious metal bearing material; the resultant molten metal is poured into ingots which are sampled at the beginning, middle, and end of the pour. Subsequent processing steps yield an extremely high degree of accuracy, with tolerance as close as ± .1% between samples.

Solution sampling

Solution sampling is used for precious metal bearing solutions, and is cost-effective as well as extremely accurate in determining precious metals content. This technique also involves achieving a homogeneous dispersion of precious metals and other constituents to the molecular level with precisions comparable to melt sampling. Multiple samples are also taken from different parts of the solution for further analysis.

3. Dry sampling
Dry sampling is used whenever materials cannot be dissolved in solution or are inappropriate to melt either because of their structure, or because of the cost associated with melting vs. the possible return. Because it is difficult to achieve homogeneity dry sampling is more complex and potentially less precise than melt or solution sampling; in fact, this method requires more judgmental skills than the others. Materials for dry sampling are homogenized, generally by grinding large pieces into smaller and ever finer particles. The material is allowed to free fall in a stream into a crosscut, timed automatic sampler. Representative samples are also taken periodically and sampling accuracy is typically ± 2%. Precious metal bearing catalysts are usually sampled with this technique.

Some precious metal bearing materials can be sampled only by one of the three methods described; however, others may be processed by more than one method depending upon variables such as the estimated value of their precious metals content, cost-effectiveness of using one method over another for highest possible returns, and practicality (a function of refining costs, materials value, and other factors). Because precious metal bearing catalysts are made in many sizes and configurations (pellets, beads, monolithic structures, and extrudates, for example), determining the best sampling technique is crucial to recovering the most value from your spent catalyst.

**4. Assaying**

Accurate and repeatable assaying procedures, on the other hand, are dependent upon sophisticated instrumentation for measuring precious metals content of materials being reclaimed. A well equipped analytical laboratory utilizes advanced X-ray fluorescence equipment, atomic absorption (AA) and inductively coupled plasma (ICP) emission spectrosopes, and incorporates classic volumetric, gravimetric, and fire assay techniques as part of its assaying regimen. When used together, these tools and techniques provide the most exacting methods for determining precious metals content in spent catalyst materials, thus assuring you the highest possible returns. In general, the specific techniques used for assaying are determined by the types of materials being processed.

**5. Processing turnaround time and your bottom line**

The speed at which catalysts are processed - and their precious metals recovered (reclamation
turnaround time) - is the third key factor of the "maximum return" equation. It stands to reason that faster turnaround minimizes interest charges the user accrues for leasing replacement precious metals. It also avoids the necessity of purchasing PGMs on a volatile spot market for use in the timely manufacture of catalysts, allowing uninterrupted processing or production.

6. Leasing and pool accounts

Typically, precious metals used for catalytic processes - especially platinum and palladium - are not purchased on an outright basis by their users. Instead, they are held in a "pool account" at one of a number of physical locations where the metal is commingled with other owners or lessees' metal. Owners or lessees of these metals "draw" on this material on an as needed basis or are provided with credit from a pool account from which to draw. From this pool users can request delivery of metals for incorporation into catalyst products.

Leasing PGMs for catalyst production is strictly a financial transaction where the user has no desire to purchase the metal but rather "borrows" it, the same as borrowing money from a bank. In the precious metals industry the practice is known as "leasing metal," and it is strictly a financial mechanism with widely varying lease rates depending upon supply and demand. In fact, the rate fluctuation is substantially greater than borrowing money from a bank at a fixed rate which is generally fairly constant and much more predictable. Most businesses can usually borrow money from lending institutions at one or two points above prime. On the other hand, metal leasing rates have been as low as 3% per annum to as high as 200%! That big difference is caused by supply and demand - nothing complicated.

In addition to leasing precious metals, there is another practice in the precious metals industry commonly referred to as "banking." This is where owners of metals will "lend" them to institutions or other businesses who pay interest charges to the owners just as a bank would pay interest on dollar deposits. These institutions, in turn, lease out these metals to users as a method of generating profits. This practice doesn't appear to be too common with regard to PGMs employed by catalyst users but is more closely associated with metals speculating or accumulation for future consumption. For example, a speculator or consumer may purchase metal today but not require it physically for six or twelve months in the future. In order to defray some of the financing costs, they may "lend" this metal back to the market.

As to when to lease and when to buy precious metals, most users make that determination based upon their perception of prevailing lease rates and their trends over extended time periods. Also, many catalyst users prefer not to "own" precious metals since they don't want their costs to appear on their balance sheet as inventory or as a fixed asset; consequently they are willing to incur added expense by leasing. Typically people who lease precious metals are not consuming them but instead using them to produce their products or having others fabricate them into catalysts. Since much of the precious metals in catalysts are recoverable, users get their metal back after the recovery and refining process.

Because of these operating practices, it is in the best interest of precious metal catalyst users to first, obtain the highest possible percent recovery for their precious metals; and, second, to work with a refiner that offers fastest possible processing turnaround time so as to minimize lease charges.
7. Recovery processing time affects your profitability

Typically it could take as long as three months to have a new catalyst fabricated and just as long to have the spent catalyst reclaimed - a period of six months during which new metals may have to be financed. Here's a simple - and realistic - example to illustrate this point: Take a 40,000 lb. shipment of 0.6% palladium catalyst valued at $700 per ounce, at a lease rate of 10%. Leasing the metal contained in this material would cost about $5000 per week. As a result, if one refiner has a six week turnaround and another a twelve week turnaround, the additional six weeks would cost $30,000 more in lease charges.

Variations in lease rates are governed by worldwide production for primary (mine production) sources and the immediate, local availability of physical metal. For the catalyst user, PGM lease rates usually represent a significant cost, since "new" precious metals are often financed while spent catalysts are being recovered and refined. By providing faster spent catalyst reclamation turnaround times, substantial cost savings may be realized, in many cases translating into thousands or hundreds of thousands of dollars each year. These are serious numbers of course, and because of this, there is a clear trend in industry towards establishing independent asset recovery programs (or departments) functioning as profit centers for the recovery of precious metals within an organization.

8. Uses for precious metal catalysts

Precious metal catalysts are used for a variety of purposes, including chemical, petrochemical, hydrocarbon, and pharmaceutical processing for facilitating reactions, for automotive exhaust systems, and in catalytic abatement processes. Many chemical/petrochemical manufacturers use fixed-bed reaction catalysts to facilitate hydrogenation of various intermediates; catalysts are also used in catalytic reactors to eliminate atmospheric discharge of volatile organic compounds (VOCs). Typical catalysts employed in the chemical processing industry incorporate platinum group metals (PGMs) which are deposited on catalyst supports such as soluble or insoluble alumina, silica/alumina or zeolites. For pollution abatement - or catalytic abatement - applications catalysts are also employed for end-of-pipe control to reduce and/or eliminate atmospheric emissions of volatile organic compounds (VOCs) and other pollutants. Catalysts used for these
applications typically contain platinum, palladium, and, to a lesser extent gold and/or rhodium, either alone or in combination.

9. The role of the precious metal refiner

This electric arc furnace photo represents the latest technology for refining spent precious metals catalysts from a variety of materials.

Regardless of how you use catalysts (or whether they take the form of monolithic structures, pellets, beads, or extrudates), you most likely depend upon precious metals refiners to reclaim the remaining precious metals from spent catalyst substrates and carriers. And there are other sources of precious metals as well from catalytic processes; these may include waste by-products such as filter cakes, papers, cloths, polishing filters, floor sweepings, and protective clothing.

Now that we’ve covered many of the financial issues with regard to recovering and refining spent catalysts, you also must consider some of the legal implications associated with processing procedures at your precious metals refiner. In addition to choosing the wrong refiner with regard to maximum recovery and fastest possible turnaround, choosing the wrong refiner with regard to possible effluent or atmospheric discharges could be even more costly.

10. Avoiding legal/environmental problems when selecting a refiner

The precious metals refining industry does not enjoy an especially sterling reputation with regard to environmental responsibility. When selecting a refiner, be aware not only of how your materials will be processed, but those of the refiner’s other customers as well. Determine how any solid, liquid, or gaseous by-product is handled at the facility. Ideally, the refiner should operate a processing facility from which no hazardous production waste materials are shipped. In addition, no pollutants should be emitted before, during, or after refining. Exhaust air quality should be managed with state-of-the-art pollution control systems, and process water evaporation should eliminate liquid effluent. While each of these functions is
fundamental, there are many hidden pitfalls surrounding them with regard to environmental regulations.

This baghouse photo represents typical environmental protection equipment employed at Sabin Metal’s Scottsville (Rochester), NY processing facility. It eliminates atmospheric emissions of all toxic, noxious, or otherwise harmful atmospheric discharges.

11. Request full documentation from your catalyst refiner

Requesting detailed documentation also may help you determine that the refiner you select does not violate any applicable environmental law or regulation. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as the Superfund Act, addresses the joint customer/refiner responsibility. This law mandates that both the company which is the source of the material for precious metal recovery and the precious metal refiner share in the “cradle to grave” responsibility as well as the future liability for the proper treatment of the material. Essentially, the environment must be protected to avoid serious financial and legal consequences: your refiner's violation of these laws or regulations could result in heavy fines and legal costs to you.

An excellent way to determine if a refining facility meets these criteria is to look for the effective utilization of sophisticated pollution abatement technology such as afterburners, baghouses, wet scrubbers, and liquid effluent neutralizing equipment. Also, evaluate the refiner's approval status with local, state, and federal agencies. A precious metal refiner should be willing to furnish copies of all required documentation. These include permits under the Clean Air and Clean Water Acts and proof whether the company qualifies as a bonafide precious metal refiner as specified in the preamble to the Boiler and Industrial Furnace (BIF) rule, and its amendments.

As an example of what can go wrong, consider this recent case:

While not directly related to reclaiming precious metals, consider the comments (in January 2000) by Carol M. Browner, Environmental Protection Agency administrator, with regard to environmental contamination: "You pollute, you pay," Ms. Browner commented at a news
conference. The news conference focused on a record $35 million fine and associated penalty against an international oil company. The case concerned two lawsuits involving more than 300 oil spills from the company's pipelines and oil facilities in six states; the oil was discharged into 16 lakes and streams. Based on the outcome of this case - which was settled by the company and EPA - it is obvious that the government means business with regard to pollution control and environmental damage.

12. Summary

There are many variables associated with recovery and refining precious metals from spent catalysts. While some of them may be more relevant (or important) to your particular application, keep in mind that they are generally interrelated so as to help you paint an overall performance picture from your precious metals refiner. Above all don't lose sight of the full compliance issues with regard to environmental regulations. All else being equal - highest possible returns and fastest possible turnaround times - the environmental issue can come back to bite you if your refiner is involved with a serious violation. Remember, whether we like it or not, we are all "partners" with government regulatory agencies as far as precious metals recovery and refining are concerned.

RTOL - July 2001