LATERITES DEAD AND BURIED OR ALIVE AND KICKING?

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The trials and tribulations of the three WA pressure acid leaching operations have been well publicised. But what effect will all of this have on the future of laterites as a major source of nickel and cobalt?

Fundamentals Remain the Same

The fact is that the fundamentals which led to such intense interest in the PAL process in the nineties for treating laterites have not significantly changed. The first is that new sulphide discoveries are only likely to replace existing resources, and that future increases in nickel production will most likely have to come from laterites. The second is that the alternative commercially applied laterite processes have serious disadvantages. Smelting is energy intensive, is only suitable for high grade saprolitic ores, and produces either ferronickel or matte. The Caron process is also energy intensive and suffers from relatively low metal recoveries. Compared with this, the PAL process has the potential for high recoveries of separate nickel and cobalt products, and relatively low net energy requirements, especially when coupled with on-site sulphuric acid production.

This has been underscored by the decision of nickel giants Inco and Norilsk to pursue new PAL projects. Inco are proceeding with the Goro project in New Caledonia, and are currently operating a major pilot plant. Norlisk have bought into WA junior Argosy's Nakety/Bogota project also in New Caledonia, for which a feasibility study is underway. Among other still active projects, nickel producer BHP Billiton also are continuing on with development studies for the Ravensthorpe project in WA.

Future Strategies

Three strategies are being pursued for the projects still in the field.

Process innovations

Inco have adopted an innovative PAL process flowsheet with some significant differences from the three WA plants and the Moa Bay operation in Cuba. These include leaching at higher temperature and pressure, a new solvent extraction step to co-extract nickel and cobalt, and refining in chloride conditions to produce cobalt carbonate via SX and nickel oxide by pyro-hydrolysis. Inco are projecting lower reagent and energy costs than the other processes.

Intermediate Product

A number of the projects are planning to make an intermediate product rather than to go all the way to metals. This approach significantly reduces the required capital, greatly simplifies the operation, and should shorten the rampup time and reduce risk. Projects adopting this approach include Nakety/Bogota which involves shipping a mixed sulphide to Norilsk for refining, Weda Bay who plan to ship a mixed sulphide to OMG in Finland, and BHP Billiton who aim to produce a mixed hydroxide for refining at QNI in Queensland. Mixed sulphide is higher grade, with fewer impurities, and has a more established market. Mixed hydroxide is lower grade and has a higher moisture content, which means that it is more expensive to ship. On the other hand, it is easier to re-leach, and it avoids the need to produce H_2S at the PAL plant site.

Leaching at Atmospheric Pressure

Interest has been mounting in acid leaching at atmospheric pressure, with BHP/Billiton, Jervois Mining, Preston Resources and Weda Bay all reported to be looking at the technology as a potentially lower cost alternative to high pressure acid leaching for their laterite projects. High pressure and temperature were adopted for the original Moa Bay plant in order to achieve acceptable acid consumption by the hydrolysis and precipitation of iron. Previous industry experience has shown that laterites can be leached at atmospheric pressure and temperatures below boiling point, but acid consumption is usually excessive due mainly to high iron dissolution. This is an obstacle that must be overcome in order to achieve an economic process.

The BHP Minerals patent for atmospheric leaching reveals that a reducing agent is used to enhance cobalt dissolution from the limonite portion of the laterite, and avoid reduction of ferric iron. The leach slurry is then mixed with sodium, potassium or ammonium ions to precipitate iron jarosite at atmospheric pressure. Acid is regenerated by the hydrolysis of the iron, and is neutralised with the low iron saprolite portion of the deposit. Nickel and cobalt are then recovered by conventional methods.

Laterites and Laterites

A number of the developing projects are based on “tropical laterites, which can be easier to treat than the Australian “dry” laterites. For example they generally do not contain significant clay minerals. Also, some of the tropical laterites are higher grade (eg New Caledonia and Indonesia). On the other hand, dry laterites are sometimes amenable to upgrading, such as at Cawse and Ravensthorpe. Also, dry areas such as WA and other parts of Australia offer the opportunity for acceptable long term tailings disposal. Sub-sea disposal in tropical areas may not always be feasible and could attract environmental opposition. Political and social stability is another key issue, which tends to favour countries such as Australia in particular.

Summing up, as long as the demand for nickel continues to increase, and in the light of the currently known resources, laterites are likely to play an expanding role. The potential advantages of the PAL process are still valid, and this is obviously recognised by majors such as Inco and Norilsk, who are actively developing new PAL projects.