David White: PRACTICAL ASPECTS OF IMPURITY CONTROL IN (NICKEL LATERITE) ATMOSPHERIC LEACHING / PRECIPITATION FLOWSHEETS

Atmospheric leaching (AL) of nickel laterites has borrowed heavily on the chemistry developed in the zinc industry for leaching nickel and cobalt and precipitating iron.

The technique used commercially involves aggressive sulphuric acid leaching of high iron limonite ores at >90 °C to produce a high iron "soup", followed by addition of easier to leach low iron, high magnesium saprolite to neutralise free acid and precipitate iron from solution.

Jarosite AL, as practised from time to time at the Ravensthorpe operation is carried out in salines waters (typically seawater salinity or higher), while goethite AL involves fresh or alkali (ammonium, sodium, potassium) free water. Both processes are naturally seeded, due to the high solids content of the leach slurry and the residence time distribution in the agitated leach tanks.

An alternative version of the Jarosite AL process involves Pressure Acid Leaching (PAL) of limonite, partial atmospheric leaching of saprolite, followed by blending of the streams to leach more of the saprolite, reduce free acid and precipitate iron. This is known as the EPAL® process.

All variants give solutions of modest iron and free acidity levels, allowing downstream processing to follow established flowsheets.

Heap leaching has been practised on a modest industrial scale at the Murrin Murrin operation, treating "scats" from the ore slurrying operation. The process uses the acidic PAL leach solution, with supplementary acid added as an agglomerating agent (typically ≈ 50 kg/t added as 98% H_2SO_4). Return PLS is treated to reduce Iron(III) to the Iron(II) state, then returns to the main process for sulphide precipitation.

This lecture will describe the practical engineering aspects of the commercial atmospheric leaching processes, including materials of construction, plant layout, sulphuric acid addition, steam heating and off-gas scrubbing.

Impurity removal upstream of nickel and cobalt precipitation and the actual precipitation processes will also be discussed.

As time allows, there will also be some discussion on nickel laterite heap leaching, including, agglomeration, stack height, slumping / heap integrity and downstream processing.