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BENCHMARKING THE HPAL PROCESS

By

Mike Miller,[1]

[1]Mike Miller Consultancy Services, Australia.

Presenter and Corresponding Author

Mike Miller

ABSTRACT

High-pressure acid leaching (HPAL) chemistry has been commercially applied since the early 1960's. The original plant, located at Moa Bay, Cuba, was the only operation of its kind until the almost simultaneous commissioning of three new HPAL operations in Western Australia in the period from late 1998 to early 1999.

The new plants differed fundamentally from the Moa Bay design in that they used horizontal, titanium-lined autoclaves for the high-pressure leaching stage. The new arrangement led to improvements in energy efficiency and scale control, but also extrapolated some of the engineering beyond known design. What many projects failed to understand was that their pilot testwork had demonstrated the chemistry of the process, but not the engineering of the plant. To that extent, these new plants were actually large-scale prototypes. During plant commissioning, some of the engineering step-outs, (together with incidental equipment deficiencies) resulted in costly delays and budget over-runs, meaning that the new operations ultimately failed to live up to expectations. The difference between projections and actual performance caused many commentators to write off HPAL technology as impractical, despite the successful commissioning of HPAL at some sites and the successful (albeit delayed) operations elsewhere.

Over the years, various authors have described the challenges faced by these operations in the form of "Lessons Learned" documents. These provide valuable perspectives into the historical commissioning and operating issues at various sites for the guidance of HPAL designers and operators. Interestingly, a collective review of these papers highlights some recurring themes; it also indicates a significant number of project issues associated with peripheral factors, which were not directly associated with the HPAL process itself.

Just as importantly, many of the "Lessons Learned" documents have glossed over aspects of the HPAL process that actually worked. As a result, industry has been quick to avoid the more obvious engineering flaws associated with the prototype plants, while failing to incorporate the process and engineering improvements at others. Many of these developments were made possible by evolutionary improvements in critical equipment (e.g. materials, valving, pumps etc), which have been largely passed unnoticed.

This present document is an attempt to compile the operating experiences (both positive and negative) associated with the "front end" elements of the various HPAL operations, while collating trends and patterns associated with successful operations.

This particular document is restricted to elements of the HPAL process from the ROM pad to the final HPAL flash discharge. These are considered in terms of process context, heat and energy transfer, chemical transformations, and mechanical equipment & materials selection.

Potential areas for further development are discussed.

Keywords: HPAL, Autoclave, Laterite, Lateritic Nickel, Pressure Leaching, Pressure Acid Leach, Process Design, Process Operations, Lessons Learned.