INTERFACIAL SCIENCE – A CRITICAL ENABLER IN HYDROMETALLURGY AND MINERAL PROCESSING

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ABSTRACT

Interfaces are encountered in every aspect of hydrometallurgy and mineral processing. Understanding the properties of the relevant interfaces and how to manipulate them is the key to effective separation processes as is demonstrated in the following four industry examples.

The first case study explores coarse particle flotation where it has been shown that there is a unique or critical contact angle below which particles *will not* float. This leads directly to the concept of a flotation domain, within which particles *can* float. The upper limits of this domain are especially relevant for coarse particles and leads to a clear understanding of why coarse particles are generally recovered more efficiently in aerated fluidized bed separators compared with mechanically agitated flotation cells.

In the second case study, the effect of fine fibrous gangue minerals flocculating with pentlandite in the highly saline process water at Mt Keith is explored. Conventional industrial dispersants are highly inefficient under these pulp conditions but dispersion of the adhering gangue slimes away from the pentlandite particles was successfully achieved using non-ionic triblock copolymers. The concepts and laboratory trials have been successful translated to plant practice.

The third case study examines the Bayer process, where alumina is produced following the digestion of bauxite at high pH and elevated temperatures and gibbsite is precipitated from supersaturated sodium aluminate solutions. Conventional physical chemical and solution theories do not apply under these extreme but actual conditions. The manipulation of long range hydrodynamic and shorter range structural forces is very important in controlling particle agglomeration in the Bayer process.

Solvent extraction using conventional mixer-settlers, a major unit operation in hydrometallurgy, is the subject of the fourth case study. The presence of particles and surfactants at the organic-aqueous solution interface can hinder the process by forming particle layers at the interface which prevent the full recovery of the organic phase and the valuable metals. A stream-based microfluidic extraction process is a promising approach for dealing with difficult, especially high value systems, in the presence of very small particles.