In-situ X-ray Diffraction Studies into Pressure Acid Leaching of Lateritic Ores

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Nickel is the earth's 22nd most abundant element but it is not found in its native form other than in meteorites. Increasing world demand for nickel is reflected by its recent price increase. The majority of nickel is refined from sulphide ores but the oxide ores or laterites (saprolite, nontronite, limonite) represent the largest reserves of this metal. There is increasing interest in pressure acid leaching (PAL) as a means of extracting nickel from laterites. PAL involves leaching of laterites in sulphuric acid under hydrothermal conditions, typically 250°C and 45 atmospheres pressure.

The saprolitic component of the ore is known to undergo rapid changes upon cooling following PAL thus making it difficult to examine using traditional post-mortem techniques. Time resolved, *in-situ*, X-ray diffraction (XRD) studies have been carried out into the reaction mechanisms of this process. The sample environment during this study aimed to closely emulate the conditions used in industrial processing plants. The novel experimental set-up used a capillary reaction vessel, short wavelength radiation and a position sensitive detector to enable rapid, simultaneous collection of a wide range of diffraction data. Quantification of the data via the Rietveld method has allowed the derivation of reaction mechanisms and kinetics.

This paper will present the results of both laboratory and synchrotron experiments within this system and will discuss the practice and perils of *in-situ* experimentation in general.

Keywords: in-situ time-resolved powder diffraction, process kinetics, quantitative phase analysis