Impact of Mineralogy on Economics of the Acid Bake Process Route for Rare Earths

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ABSTRACT

The sulfuric acid bake route is well established, conventional technology for the processing of rare earth ores / concentrates and represents the preferred process for the majority of current major rare earth producers and many developing projects. The performance of the bake process and the optimal operating parameters vary substantially from project to project, with variations in feed mineralogy being a key contributor. The process, and in particular the baking step, must therefore be tailored to each specific rare earth project. Hitherto, there has been little understanding of these variations or of the fundamentals of the acid bake process.

This work draws on long-standing engagement with industry in acid bake process development combined with substantial investment into fundamental process studies to reveal some of the core chemistry driving the observed performance variations. Impacts of specific key gangue minerals on rare earth recoveries and impurity deportment are quantified and the complex interplay of these effects with process conditions is unravelled. Results from both deleterious and beneficial gangue minerals are presented, and the observed alterations in performance are translated to quantifiable impacts on cost of operation.

The utilisation of this fundamental understanding of bake chemistry to predict bake performance based on feed mineralogy is demonstrated, in addition to manipulation of the feed composition to achieve enhanced performance and ameliorate effects of (typically) deleterious gangue. Finally, key implications for the industry and developing junior projects are discussed.