Vessel Diagnosis in the Bayer Process Using Ferromagnetic Tracers

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Abstract

In the Bayer process, having a good knowledge of the residence time distribution (RTD) of thickened slurry and pulp flows can help achieve a more efficient operation, diagnose problems such as channeling and dead zones, or evaluate the effectiveness of operational parameters. A tracing procedure and apparatus was developed by Rio Tinto in partnership with the Université du Québec à Chicoutimi to monitor slurry displacement patterns. The principle of the apparatus is the detection of a solid ferromagnetic tracer by inductance coils. The RTD obtained is then analyzed with a proprietary Rio Tinto deconvolution method to understand the different flows inside the vessels. Iron powder is usually utilized as a tracer for its compatibility with slurry of bauxite residue. However, magnetite has been successfully tested as an alternative tracer since it can be used at higher temperature and higher caustic concentrations than typical Bayer washer circuit conditions. The tracing technique was validated at plant scale for the diagnosis of slurry behavior in deep thickeners, stirred tanks, and pipes.

Keywords: Residence time distribution; tracer; flow; diagnosis; ferromagnetic; tanks; pipes.