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NICKEL LATERITES — GRADE DEFINITION AND PROCESS OPTIMIZATION BY MINERALOGICAL MONITORING USING X-RAY DIFFRACTION XRD

By

Uwe König

Malvern Panalytical B.V., The Netherlands

Presenter and Corresponding Author

Uwe König

ABSTRACT

Nickel laterite production is on the rise, surpassing conventional sulfide deposits, to ensure global supply in the future. Nickel laterite ore is used to produce nickel metal, predominantly to manufacture stainless steel as well as nickel sulfate, a key ingredient in the batteries that drive electric vehicles.

The efficiency of mining and processing nickel laterites is defined by their mineralogical composition. Typical profiles of nickel laterites are divided into a saprolite and a laterite horizon. Nickel is mainly concentrated and hosted in a variety of secondary oxides, hydrous Mg silicates and clay minerals like smectite or lizardite in the saprolite horizon, whereas the laterite horizon can host cobalt that can be extracted as a side product.

A case study from both saprolite and laterite horizons was performed using X-ray diffraction (XRD) in combination with statistical methods such as cluster analysis. Besides the identification of the different mineral phases, the quantitative composition of the samples was also determined with the Rietveld method. Data clustering of the samples was tested and allows a fast and easy separation of the different lithologies and ore grades.

Mineralogy also plays a key role during further processing of nickel laterites to nickel metal. XRD was used to monitor the mineralogy of calcine, matte and slag. The value of mineralogical monitoring for grade definition, ore sorting, and processing will be explained in the presentation.

Keywords: nickel laterite; ore sorting; XRD; Rietveld; cluster analysis