

Characterization of Ni laterites using a combined approach

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The development of new extraction techniques and the mineral processing optimization are now mandatory because of the increase in the global request of critical raw materials¹. Within the mining cycle, the exploration stage is crucial to obtain information on tonnages and grades of ore bodies and the data acquired within this stage must be reliable and available within a short time. The usual approach consists in extracting cores, sampling them, sending the specimens to a distant laboratory for the analysis, and waiting for the results. This process is long, time consuming, expensive, and not environmentally friendly. In particular, as for Nickel extraction, an intensive exploration drilling needs to be carried out, due to the high variability and heterogeneities of laterite ore. Flexible techniques, in terms of sample preparation and data acquisition, are typically used in this case, mostly using IR-based techniques, X-rays fluorescence, and hyperspectral imaging. However, none of these methods is capable to provide a fully satisfactory response for several reasons, the main one being the complexity of mineral ores. In this regard, the effective multi-analytical approaches are usually conducted in structured laboratories on selected samples, due to the strong time/costs constraints. A possible alternative solution, which is currently being developed within SOLSA (Sonic On Line Sampling and Analysis), a joint EU H2020 project, relies on a multi-analytical approach using an on-site instrument to carry out both data collection and complete mineralogical and chemical analysis. An automatic expert system coupling sonic drilling, imaging, profilometer, hyperspectral cameras, and a combination of Raman spectroscopy (RS), X-ray fluorescence (XRF), and X-ray diffraction (XRD) is under construction. The base principles on the cooperative approach of RS-XRD-XRF will be discussed and applied to specific test samples, showing the potential and the novelty of the method^{2,3}.

[1] R. Mills, <http://www.mining.com/critical-raw-materials-revisited/>, 2012.

[2] M. Secchi et al., accepted by *Journal of Raman Spectroscopy*, **2018**.

[3] M. Bortolotti, L. Lutterotti, G. Pepponi, *Powder Diffr.*, **2017**, 32, S225–S230.