

Assessment of rare earth elements (REEs) speciation variability in bauxite residues (BRs) of various origin, age and storage conditions as a tool to guide selective REEs leaching

JULIEN COUTURIER^{1,2}, PIERRE TAMBA OULARÉ^{3,4},
CLAIRE LALLEMAND¹, ISABELLE KIEFFER⁵, PERRINE
CHAURAND⁶, BLANCHE COLLIN⁶, JEROME ROSE⁶,
DANIEL BORSCHNECK⁴, BERNARD ANGELETTI¹,
STEVEN CRIQUET⁷, GUILHEM ARRACHART² AND
CLEMENT LEVARD⁸

¹CEREGE, Aix Marseille Univ, CNRS, IRD, INRAE, Coll France, CEREGE UMR 7330

²ICSM, Univ Montpellier, CEA, CNRS, ENSCM, 30207 Marcoule, France

³ISMGB, Boké, Guinée-Conakry

⁴Aix-Marseille Univ, CNRS, IRD, INRAE, CEREGE, 13545 Aix-en-Provence, France

⁵OSUG, Université Grenoble-Alpes, CNRS, Grenoble, France

⁶Aix Marseille Univ, CNRS, IRD, INRAE, Coll France, CEREGE UMR 7330

⁷Aix-Marseille Univ, Avignon Université, CNRS, IRD, IMBE, Marseille, France

⁸CEREGE, Aix Marseille Univ, CNRS, IRD, INRA

Presenting Author: couturier@cerege.fr

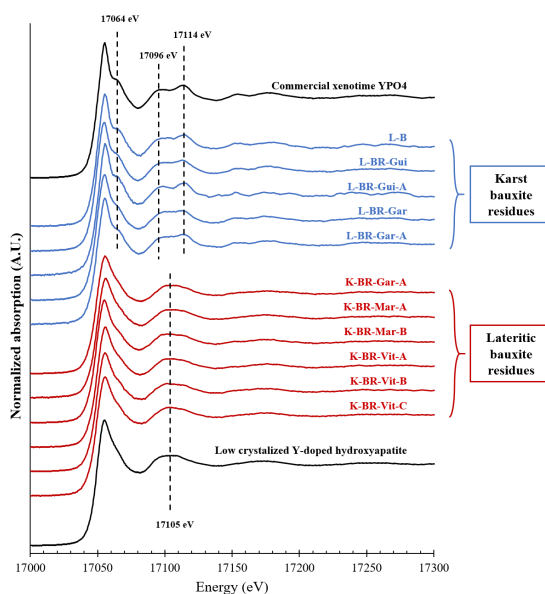
With about 170 million tons generated and stored per year, easily accessible storage sites and fine granulometry, bauxite residues (BRs) seem to be good candidates as secondary sources of metals. In particular, this industrial waste generated from alumina production, contains high REEs contents (up to >2000ppm).

Promising results were obtained for the metal recovery after complete dissolution and numerous separation stages. However, these steps are very costly and also generate wastes that are difficult to treat. The development of more sober processes, based on a more selective dissolution and less impacting solvents, seems to be a good alternative to the classical hydro/pyrometallurgical processes. Nevertheless, this requires a favourable speciation of the targeted elements in the waste. Another important question concerns the reproducibility of an extraction process to BRs produced in other places worldwide with different origin, age and storage conditions.

In this context, our work proposes first to study the variation of REE speciation in BRs, depending on the nature of primary ore (karstic or lateritic), the ageing time and the storage conditions of the tailings. A multi-scale characterization of BRs, including XAS measurements at ESRF synchrotron and SEM-EDX observations, were performed. Secondly, we assess the effect of this speciation variability on selective leaching results based on green solvents, as organic acids or deep-eutectic solvent.

The main results show a variation in the speciation of yttrium, as a heavy REE proxy, depending on the kind of the primary bauxites from which the BRs are obtained. However, no major variation as a function of treatment and/or ageing of the BR is observed. Yttrium is found in the form of xenotime phosphate in the lateritic tailings, and in an unidentified form containing minor amount of pure Y-phosphate in the karst tailings. The REEs leaching behaviour with citric acid as a function of speciation will be discussed. We also observed significant differences between light and heavy REEs on lateritic BRs that we attribute to speciation changes and that we are currently exploring.

This work will give first indications in order to generalize the REEs recovery by selective processes from different BRs worldwide.



XANES spectra of bauxite residues of different origin compared to two model compounds