Towards a sustainable recovery of valuable metals from mining residues: a XANES approach to tungsten speciation in debris from the Panasqueira mine

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Tungsten displays unique physical-plus-chemical properties that hinder its replacement in relevant specialized industrial applications and render it a metal of high strategic importance, nowadays considered a critical commodity in the EU. Believed to be mainly transported by high-temperature magmatic fluids [1], tungsten has long been mined at Panasqueira (Beira-Baixa district), making Portugal the main European producer. With a history surpassing a century, this mine has given rise to a huge tonnage of debris (attaining 0.3% WO_3 at Barroca Grande slimes [2]). Considering Horizon 2020 objectives and recent EU efforts to implement a sustainable retrieval of critical mineral resources, it is a mandatory purpose to enhance the recovery of tungsten from those mine tailings and, simultaneously, to identify mineral phases carrying other scarce metals (e.g. rhenium, that according to recent analyses [3] occurs in those debris at a level exceeding ten times its mean concentration in the Earth´s crust). The association W-Re was focused in studies on WO_3 powders for electrochromic and catalytic applications and the occurrence of W^{5+} ions with a localized $5d^1$ electronic configuration was then assigned in $(1\text{-}x)WO_{3\text{-}y}.xReO_2$ synthetic combinations [4]. Accordingly, to pursue the above quoted objectives it is appropriate to look for the eventual occurrence of similar phases in the Panasqueira mine tailings by combining X-ray diffraction (XRD) with X-ray absorption spectroscopy at W L_1- and L_3-edges (XANES) using synchrotron radiation. The results of a preliminary experiment [5] carried out at the ESRF using the instrumental set-up of beam-line BM 25-A (SpLine) are described and the aims of a future experiment are briefly addressed.

References

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