

Recovery of tantalum from secondary sources by alkaline leaching: advances in speciation and recovery

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The chemical element tantalum (Ta) belongs to the group of refractory metals. The electronics industry consumes almost half of Ta for the production of capacitors, but Ta is also used in the aerospace, medical equipment, and industrial equipment sectors. Within the European Union, Ta is on the list of the 34 critical and strategic raw materials. Extractive metallurgy of ores is limited to a few countries, and non-traditional resources are needed to supply the European industry [1]. Ta can be extracted as a by-product of tin smelter waste, but old slag dumps are also interesting sources. A promising domestic source is the waste from electrical and electronic equipment (WEEE).

Hydrometallurgical processes used for ores could be suitable for the recovery of Ta but the most common involves the use of concentrated hydrofluoric acid, followed by a solvent extraction. This method has been criticised on safety and environmental grounds, leading to research into alternative extraction methods. In our work, we investigate soluble tantalum compounds obtained after an alkaline attack. The first part is dedicated to the speciation of Ta(V) at high pH, since its chemistry is complex (formation of hexatantalate ions) and still poorly understood. A multi-spectroscopic approach has been carried out, with the first measurements using *in-situ* infrared spectroscopy (ATR FT-IR) and *ex-situ* high-energy resolution fluorescence detection X-ray absorption near-edge structure spectroscopy (HERFD-XANES). The second part focused on the separation of Ta(V). The use of magnesium salt has allowed the formation of a crystalline magnesium hexatantalate that has not been previously documented or characterized. This selective precipitation is followed by a redissolution in Mg-complexing media, leading to a Ta₂O₅ solid free from Mg and Na impurities, using a solvent-free process.

Reference

[1] N. Generowicz et J. Kulczycka, « Recovery of Tantalum from Different Resources », *Archit. Civ. Eng. Environ.*, vol. 13, n° 4, p. 79–84, janv. 2020, doi: 10.21307/acee-2020-031.