Extraction of Platinum Group Metals from Chloride Leachate of End-of-Life Car Exhaust Catalysts using Undiluted Ionic Liquids

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Platinum group metals (PGMs) (i.e. Pt, Pd, Rh) are key materials for catalysts for automotive exhaust gas treatment. The significant increase in the deficit of PGMs forecasted for the coming years (i.e. 93.6 tonnes or 3.3 million oz Pt in 2020) is calling for more attention to recover these critical elements [1].

The Horizon2020 PLATIRUS project (PLATInum group metals Recovery Using Secondary raw materials) aims at reducing the European deficit of PGMs, by upscaling to industrial relevant levels a novel cost-efficient and miniaturized PGMs recovery and raw material production process. The targeted feedstocks are end-of-life car exhaust catalysts, electronic waste, tailings and slags from nickel and copper smelters [2].

In fact, the separation and purification processes of PGMs face a continual challenge due to their refractory chemical properties and the formation of many chemical species in chloride media, which is typically chosen for their hydrometallurgical recycling. In addition, the conventional liquid–liquid extraction of PGMs using molecular extractants (i.e. TBP, Cyanex 923, TOPO, Alamine 336, Chelex 100) suffers from drawbacks of slow kinetics and poor selectivity [3].

More recently, ionic liquids have been widely considered in hydrometallurgy towards green extraction of metals [4, 5]. In practice, ionic liquids with hydrophobic cations in combination with simple anions (i.e. Cl^-, NO_3^-, etc.) such as Cyphos IL 101 and Aliquat 336, are preferred in solvent extraction. Nevertheless, previous studies reveal that these ionic liquids are mostly used as new extractants and/or ion-exchangers in the classical approach, i.e., diluted in molecular solvents [6, 7].

In the framework of the PLATIRUS project, we developed the split-anion extraction approach [8] as an innovative and sustainable recovery of individual PGMs from acidic chloride media using undiluted ionic liquids. Different types of ionic liquids were synthesized, characterized and tested for the selective extraction and separation of PGMs.

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