Platinum dissolution - from fuel cells degradation to recycling.

Nejc Hodnik

Department of Catalysis and Chemical Reaction Engineering, National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia

E-mail: nejc.hodnik@ki.si

Platinum, as one of the precious metal, is not only rare and of high economic interest but more importantly, deeply integrated into our society through electrical and electronic equipment and catalysis, which are key enabling technologies for our high life quality. This is due to platinum's very high corrosion resistance. Pt is also one of the most well know and the most studied electrocatalyst. It is used to accelerate numerous important reactions like oxygen reduction, hydrogen and methanol oxidation, etc., utilized in the electrochemical energy conversion reactors like fuel cells and electrolyzers. Also, one-third of platinum supply is consumed for the production of automotive catalytic converters. For this reason development of different kind of nanoparticles as active and stable catalysts is very popular through the materials science community.

Due to increase in Pt consumption, it is predicted that the supply will not be able to meet the demand. It is, thus, likely to assume that the Pt supply will become a bottleneck for catalysts production. It's natural ores concentrations are already at the relatively low-level and to a large extent only found in South Africa. Several states, for example, US, Japan and EU, have already recognized importance of the supply risk and, consequently prepared a so-called critical raw material (CRM) list. For this reason the chemistry of recycling of platinum from end-of-life products, also referred as urban-mining, is becoming essential. However, due to Pt resistance to corrosion, platinum leaching relies on extremely aggressive and hazardous processes, for example, boiling aqua regia; a mixture of concentrated nitric and hydrochloric acid. In this presentation, I will explain how we transferred knowledge from Pt electrocatalysts stability studies to completely new Pt hydrometallurgical recycling [1].

References:

[1] Nejc Hodnik, Claudio Baldizzone, George Polymeros, Simon Geiger, Jan-Philipp Grote, Serhiy Cherevko, Andrea Mingers, Aleksandar Zeradjanin & Karl J. J. Mayrhofer. Platinum recycling going green via induced surface potential alteration enabling fast and efficient dissolution. *Nature communications*, **2016**, 7, pp. 1-6,