Deep eutectic solvents as a sustainable alternative to water in advanced material processes

Georgios Kolliopoulos

Department of Mining, Metallurgical, and Materials Engineering, Université Laval, Québec, Québec

Résumé/Abstract

Water is a rather eccentric compound: it sustains life on the planet and yet, its use in processing to-date is nothing but sustainable. Mineral and metal processing rely on aqueous chemistry, which involves vast amounts of water, and result in increasingly larger volumes of contaminated aqueous effluents that must be treated and disposed in tailings ponds. In this talk, I will present the path towards a sustainable transition towards green water-free solvometallurgical processing. Deep eutectic solvents (DESs) are eutectic mixtures of inexpensive, non-toxic, biocompatible salts. DESs can effectively replace water and aqueous solutions in processing be that in chemical or physical metallurgy. DESs have tunable properties, which enable us to tailor the liquid properties to make it selective to targeted metals or materials. Therefore, when properly selected, DESs offer an eco-friendly alternative to current state-of-the-art hydrometallurgical processes by minimizing waste generation as well as water and acid/base consumption whilst maintaining or improving the levels of selectivity in metal recovery. Finally, solvometallurgical processing promises to

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improve advanced material design processes by eliminating parasitic reactions during metal electrodeposition, such as H2 gas evolution, due to the absence of water from the system.

Bio

Dr. Georgios Kolliopoulos is an Assistant Professor in the Department of Mining, Metallurgical, and Materials Engineering at Université Laval since September 2019. He obtained his PhD from the Department of Chemical Engineering and Applied Chemistry, University of Toronto, in 2018, after completing his undergraduate studies in Mining and Metallurgical Engineering at the National Technical University of Athens, Greece, in 2013. His research focuses on the development of sustainable zero-waste extractive metallurgy processes that aim to minimize the use of water and acid/base reagents from process circuits and the overall environmental impact of mineral and metal processing. To-date, his research portfolio includes studies in platinum group metal recovery from spent automotive catalysts, solubility studies of rare earth sulphates in aqueous media, critical and strategic metal recovery from waste electronics, water recovery from industrial effluent streams via forward osmosis and freeze desalination, and adsorption of high impact inorganic pollutants from contaminated waters. His achievements so far have resulted in several scholarships and awards including the Metallurgy and Materials Society of CIM Doctoral Scholarship (2018), the Connaught Scholarship for International Doctoral Studies (2013-2018), and the Technical Chamber of Greece (2017) and the Limmat Foundation (2014) awards of academic excellence.