Metals recycling from industrial materials — can one learn from nuclear fuels reprocessing?

Andreas Geist

Karlsruhe Institute of Technology (KIT), Institute for Nuclear Waste Disposal,
76021 Karlsruhe, Germany
andreas.geist@kit.edu

Recycling metals from industrial materials requires separating them from complex matrices and from one another. While extraction (more precisely, chemical solvent extraction) is widely applied in the hydrometallurgical production of metals from primary sources, its use for recycling metal from industrial materials appears to have potential for growth. Solvent extraction may be regarded a powerful unit operation for such recycling processes, due to the unique selectivity achievable.

Chemical solvent extraction has always been a companion to nuclear energy generation, be it for the production of pure uranium from ores, the reprocessing of used nuclear fuel to reuse uranium and plutonium, or, more recently, for the development of advanced nuclear fuel cycles. The latter are not (yet) employed on an industrial scale; nevertheless, a number of systems has been developed to separate actinides from complex feed solutions. Further to actinides, these feed solutions contain a variety of transition metals, lanthanides, and platinum group metals. Although these metals are typically to be rejected, the extracting agents used show interesting extraction properties for some of them.

This presentation discusses solvent extraction processes developed for advanced nuclear fuel cycles, how their chemistry was optimised, and whether these could be of potential interest to the non-nuclear recycling. Furthermore, it points out how fundamental studies can help improving our understanding of how such processes work on a molecular scale. Indeed, this knowledge in turn has inspired the development of new solvent extraction systems.