MONASH University

Novel chemical encapsulation: gold recycling from e-waste

PHYSICAL SCIENCES: Processing

The Challenge	With diminishing ore stocks and an ever-growing demand for metals and minerals, metals recycling has become critical. E-waste is a surprisingly abundant source of precious and base metals (up to 30x more than an ore). Extraction of metals from e-waste streams is typically performed using high-energy, high-cost processes developed for mining operations. These processes are often ill-suited to the scale, location and chemistry of the material, making e-waste recycling a marginal proposition. An ideal extraction technology would possess the following characteristics: • Selective for the material(s) of interest • Low reagent utilisation • Ambient conditions • Minimal waste production Encapsulation is well-suited to these problems.
The Solution	The Monash team have developed a novel encapsulation process. One of the uses of this new technology is rapid, selective and environmentally friendly extraction of gold from e-waste streams. This easily scalable process seeks out the valuable components, before binding and separating them from low value components, to allow economic metal recycling.
Key benefits	• Targeted Gold extraction using encapsulation • Rapid reaction for high-throughput • Easily scalable • Recyclable
Development Stage	Proof of Concept
Brief Description & Differentiation	This new technology focuses on encapsulation for gold extraction 1. Functionalised capsules seek gold regions 2. Chemicals for gold dissolution are released in a highly localised fashion promoting rapid dissolution 3. The highly specific encapsulation process occurs to capture gold 4. >90% Capsules with gold can be separated in a pure concentrated stream in 2 to 5 hrs from the low value-e-waste 5. Capsules can be re-loaded and recycled for use. Other e-waste metals can be targeted for encapsulation technology.
Research Team	The inventors for this technology are Dr Shane Meaney, Dr Rico Tabor, and Prof Bart Folink.
Intellectual Property	PCT application filed in 2019.

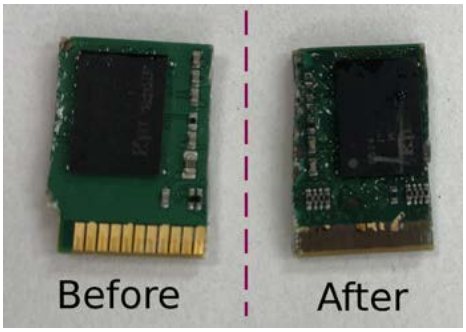

Figure 1: Circuit board before and after capsule processing. Extraction specific for gold.

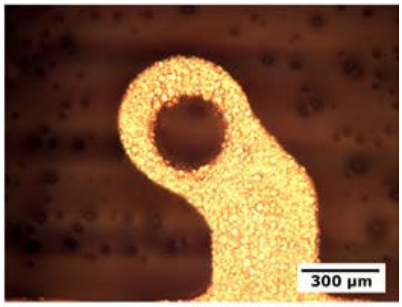

Figure 2: Capsules adhered to circuit board component. Note the high specificity for the gold region.

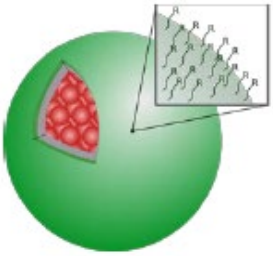

Figure 3: Schematic of the encapsulation scheme. Core contains a concentrated reagent for metal dissolution. Shell is functionalized to adhere to specific metallic targets.