# Catalytic dissolution of metals from printed circuit board using a calcium chloride-based deep eutectic solvent

Rodolfo Marin Rivera*, Guillaume Zante, Jennifer M. Hartley, Karl S. Ryder, Andrew P. Abbott

*School of Chemistry, University of Leicester, Leicester, LE1 7RH*

** Corresponding author. Email address: ramr1@le.ac.uk*

## Supplementary information

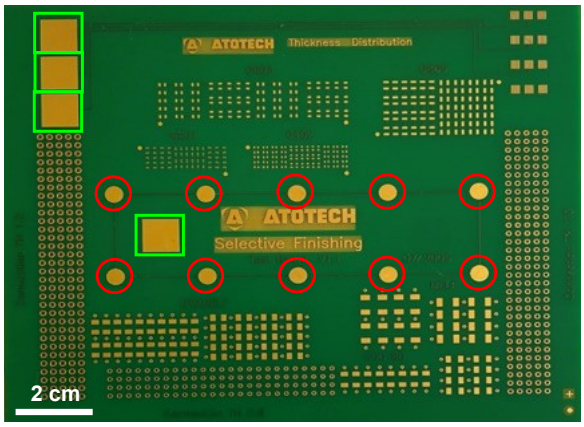


Figure S1: Gold-coated printed circuit board with block terminals of circular (in red circles) and square (in green squares)-shaped geometries.

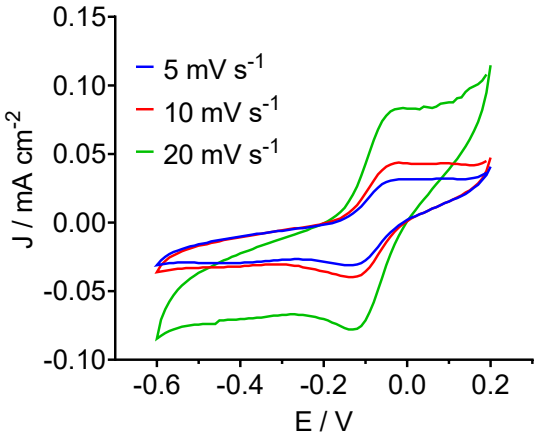


Figure S2: Cyclic voltammograms of 0.01 mol $dm^{-3}$ solutions of $K_3Fe(CN)_6$ in $CaCl_2{\cdot}6H_2O$: EG (1:1 ratio). Scans were recorded at a 1 mm diameter Pt disc working electrode vs. Ag/AgCl in 3 M KCl reference at room temperature.

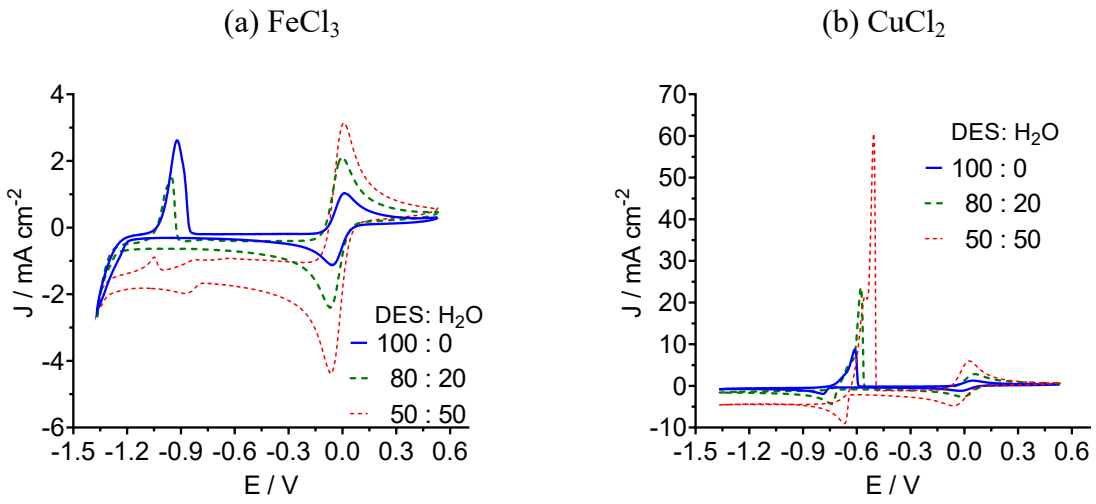


Figure S3: Cyclic voltammograms of the solvents obtained after copper powder dissolution (5 mg) in the presence of 0.1 mol $dm^{-3}$ of (a) $FeCl_3$ and (b) $CuCl_2$ as oxidising agents in $CaCl_2{\cdot}6H_2O$: EG. The legend describes the $CaCl_2{\cdot}6H_2O$: EG (DES)-to-water ratio. The experiments were performed in 10 mL of $CaCl_2{\cdot}6H_2O$: EG.

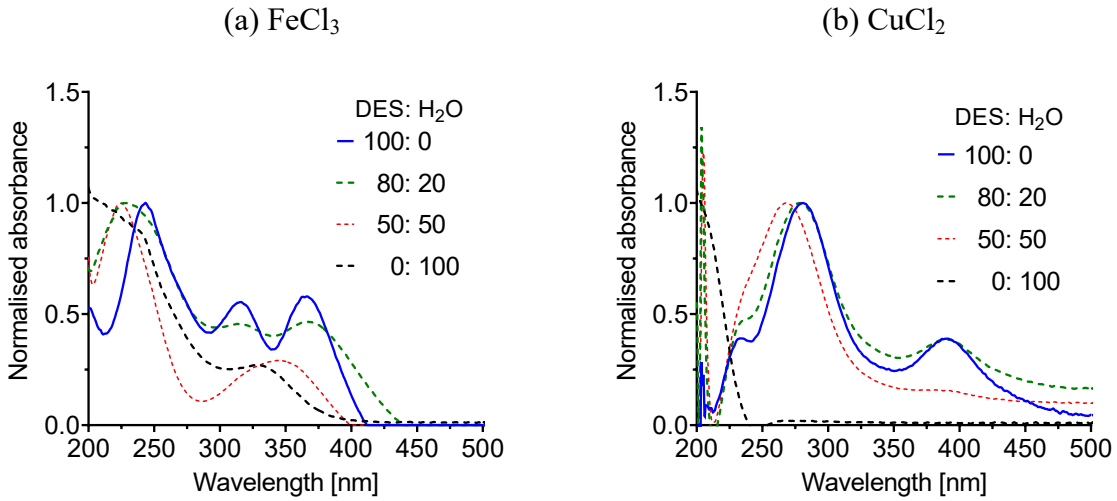


Figure S4: UV-vis spectra of the solvents obtained after copper powder dissolution (5 mg) in the presence of 0.1 mol $dm^{-3}$ of (a) $FeCl_3$ and (b) $CuCl_2$ as oxidising agents in $CaCl_2{\cdot}6H_2O$: EG at 50 °C. The legend describes the $CaCl_2{\cdot}6H_2O$: EG (DES)-to-water ratio. The experiments were performed in 10 mL of $CaCl_2{\cdot}6H_2O$: EG.

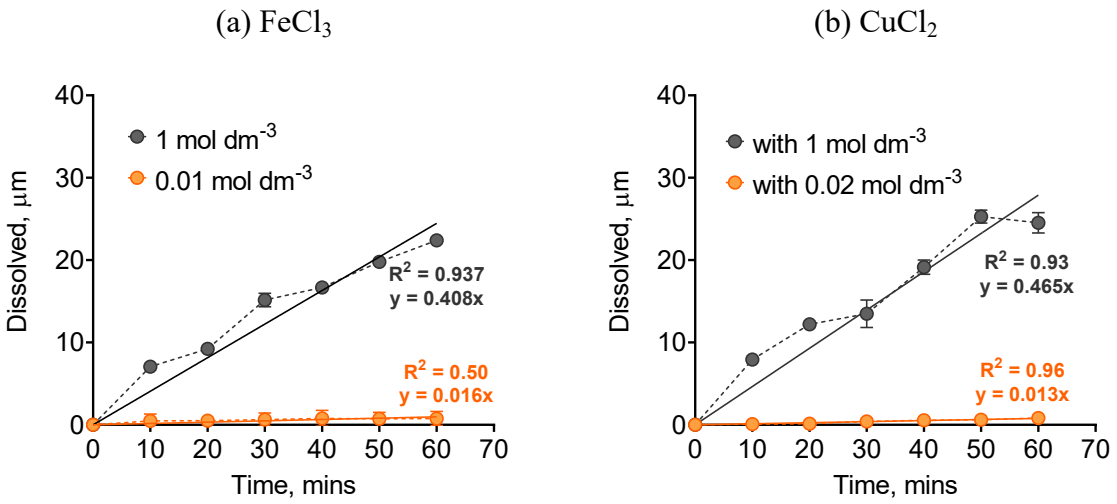


Figure S5: Etch depth of copper over time from the cross section of a square-shaped block terminal with two different concentrations of (a) $FeCl_3$ and (b) $CuCl_2$ as oxidising agents in the $CaCl_2{\cdot}6H_2O$: EG eutectic system at 25 °C. The corresponding trend lines are also shown.

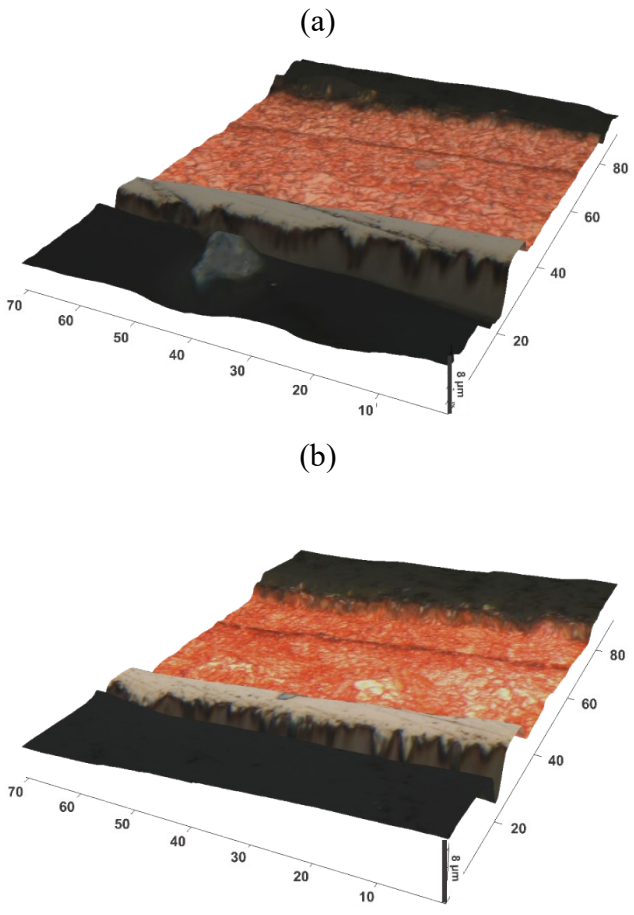


Figure S6: 3D reflected light image of the cross section of a printed circuit board block terminal with (a) 0.02 mol $dm^{-3}$ $CuCl_2$ and (b) 0.01 mol $dm^{-3}$ $FeCl_3$ in $CaCl_2{\cdot}6H_2O$:EG (1:1 ratio), for 1 hour at 50 °C. The reddish-brown area describes the copper layer and, the white-greyish area describes the nickel layer. The dark area corresponds to the resin holding the printed circuit board sample.