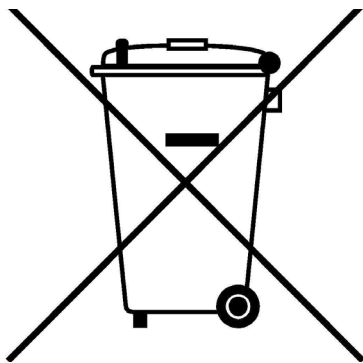


From e-waste to green energy - An investigation of trends in precious metal and copper content of RAM modules in WEEE: Implications for long term recycling potential



Rhys Charles
Industrial Sponsor – Metech



Rhys graduated from Cardiff University in 2007 with a 1st class BSc in Chemistry. After spending time working in waste management, Rhys enrolled in the COATED CDT working on a project sponsored by Metech examining the how to utilise waste electronics to recover precious and heavy metals for use in coatings in solar cell technology¹. Here, Platinum from waste electronics was recovered as chloroplatinic acid, a critical chemical used in the manufacture of dye sensitised solar cells where it is used to deposit an optically transparent layer of Pt that catalytically controls chemical reactions permitting energy generation from such devices. He has since presented at 7 conferences and published a paper in a leading journal of the field².

Waste Electrical and Electronic Equipment (WEEE) is the fastest growing waste stream on the planet with global generation reaching 41.8 million tonnes per year in 2014. It is predicted to increase by 3 -5% annually and accounts for 5% of all municipal waste. Often critical materials such as gold, palladium, copper and silver exist in higher proportions in WEEE than in their naturally occurring ores and is thus a valuable source of such elements that have critical usage in the new generation of flexible solar cells for the construction sector. In Rhys' latest paper² he examined Dynamic RAM placed on the market between 1991 and 2008. The anatomy of a DRAM module in terms of metals is shown in figure 1. The miniaturisation and thrifting in manufacturing makes predictions of recycling rates of WEEE difficult. Rhys used Atomic Absorption Spectroscopy and image processing to conduct a linear regression analysis of compositional data ordered according to sample chronology to identify historic temporal trends in module composition resulting in changes to manufacturing processes. He found that quantities of metals such as gold and silver remained stable over the years and are likely to remain that way. Palladium is predicted to fall amount whilst copper is expected to increase by 75%. Rhys noted that changes away from PCs towards tablets and phones coupled with a greater reliance on cloud based data storage will help to drive the miniaturisation of WEEE.

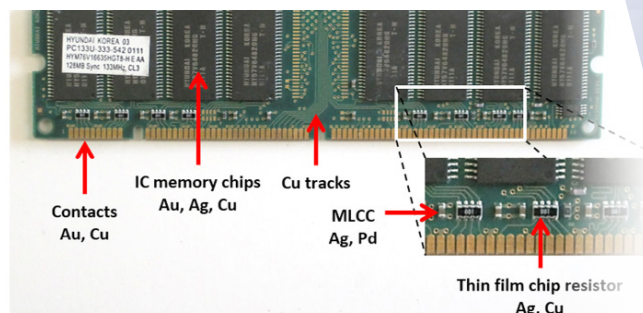


Figure 1. Anatomy of a DRAM module

Rhys' expertise has been utilised by the Welsh Government to inform policy on circular economy and he was also invited to the "APSRG Parliamentary debate" on the recast of UK WEEE regulations that led to participation in EU policy consultations in Brussels.



Scan for reference 1

¹ https://www.youtube.com/watch?v=ptE1B-_hyXE

² Waste Management, 2016, article in press, DOI: 10.1016/j.wasman.2016.11.018