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Hydrometallurgical process development for metal recovery from printed circuit board waste

WEEE Industry-meets-Science Workshop
8 March 2016

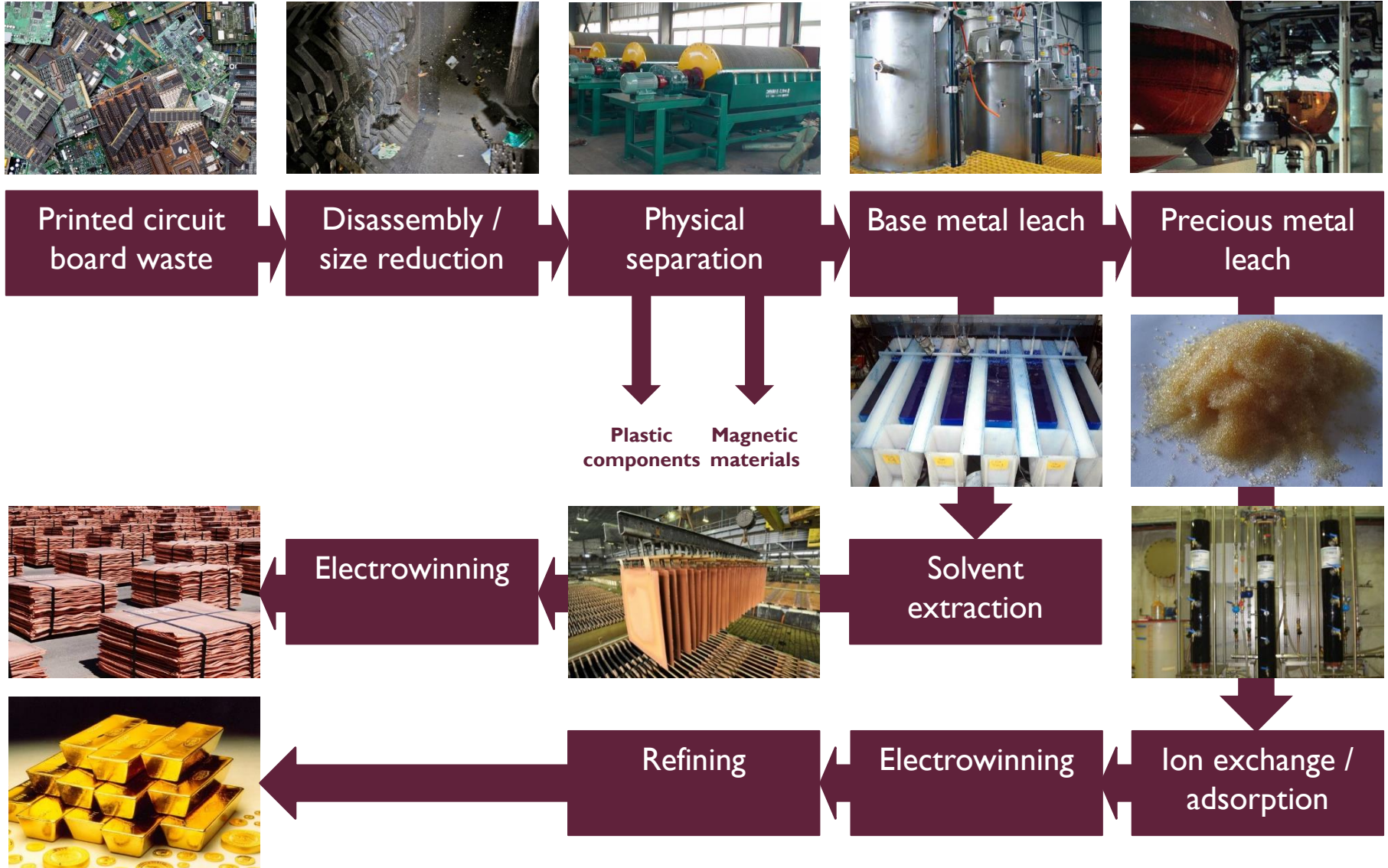
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Current WEEE activities: background

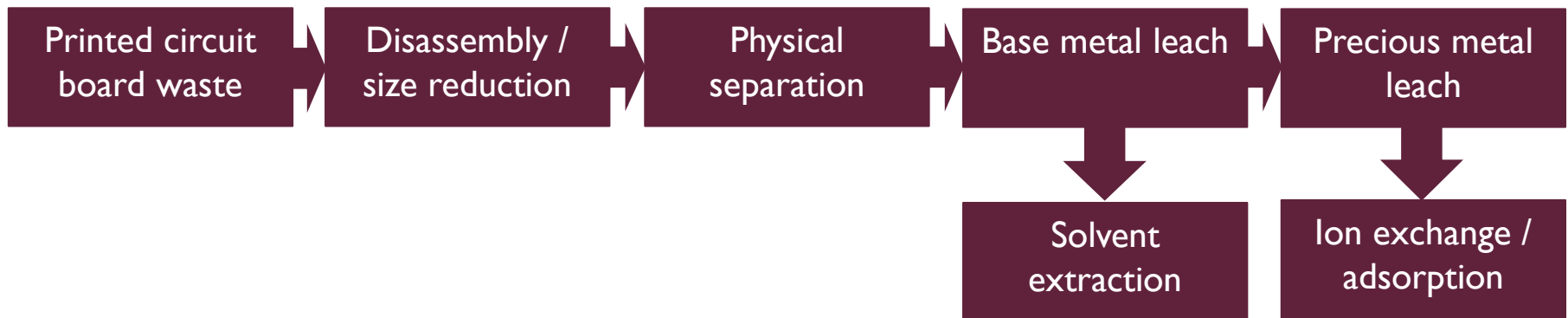




Current WEEE activities: research focus



- Integrated process design and optimisation
 - Effect of mechanical pre-treatment on leaching efficiency
 - Comparing the efficiency and sustainability of metal recycling processes by means of LCA and exergy analyses
- Alternative lixivants
 - Thiosulphate leaching of gold from PCB waste
 - Application of novel ore leaching process for PCB treatment
 - Base metal recovery from leach solutions





Current WEEE activities: outputs to date



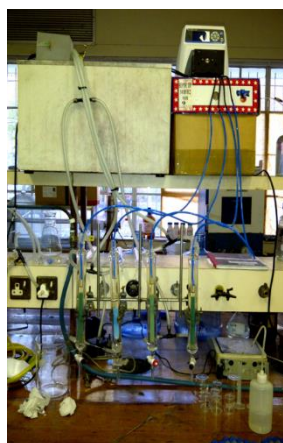
- 8 completed final-year research projects
- 1 graduated MEng student
- 4 current MEng students
- 3 poster presentations at national conferences
- 1 full-length international conference article under review



Current WEEE activities: facilities



- Material preparation (crushers, mills, sieves, splitters)
- Leaching autoclave, atmospheric leaching, columns
- Bottle roll rigs
- Continuous mixer-settler, ion exchange columns
- Electrochemistry: potentiostat, RDE
- Muffle, induction, and DC plasma arc furnaces
- Analytical facilities
 - Ion chromatograph, AA, PSD, TGA, ICP-AES
 - ICP-MS, XRF, SEM





Obstacles to WEEE recycling



- Regulation of waste disposal activities
 - Insufficient legislation
 - Legislation not enforced to ensure compliance
 - Lack of recycling targets and collection goals
- End-of-life product management
 - Insufficient collection schemes
 - No formal framework or incentives for take-back of products
- Infrastructure
 - Inconvenience of collection and recycling
 - Recycling plant infrastructure
- Economic viability of WEEE recycling
 - Economy of scale required for different processing technologies
 - Uncertainty about best available technology and appropriate business models
- Education on environmental impact of WEEE



Opportunities for increasing WEEE recycling



- **Products / fractions**
 - Rare earths and critical elements (In, Ga, Ge, etc.)
 - Identify elements that are of long-term strategic importance
 - Precious metals
 - Possible integration with existing precious metal refineries
 - Zero waste approach
 - Integrated process design required for maximum sustainability
- **Industry structure**
 - Small business units / local processing / job creation
 - Regulations/measures to encourage establishment of WEEE processing facilities based on best available technology



Current gaps in knowledge



- **Economics of recycling and waste treatment**
 - Techno-economic assessment of different recovery processes
 - Quantify contribution to socioeconomic development and sustainability
- **Waste management**
 - Waste stream blending to enhance processing
 - Opportunities for mining of existing landfill sites
- **Best available technology**
 - Continuously changing WEEE composition and increasing complexity
 - Environmentally benign processes suitable for small scale operation
 - Incorporation in existing primary source treatment facilities



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