Precious Metals in Waste Material

The aim for this project is to better understand how precious metals (gold, silver and REE, rare earth elements) can be recycled from WEEE material, Waste Electrical and Electronic Equipment. An improved knowledge of how precious metals occur in our waste can potentially reduce the losses of valuable materials and possibly change how we today treat our waste.

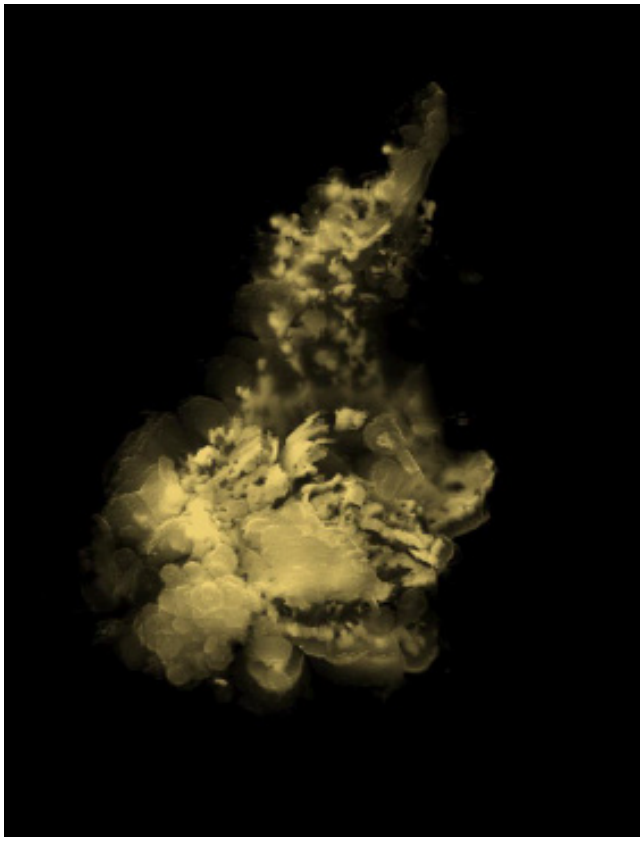
Today, considerable amounts of precious metals are lost in the recycling process, partly due to that the political recycling goals are quantitative rather than qualitative, partly due to the fact that the present low price levels for these materials are not a driver to increase the recycling rates. However, these two stipulations can change rather quickly in the future, and it is important to increase the recycling levels of these materials due to sustainability, and a less dependence on import from China.

The main activity in the project was to take samples from WEEE, make sample preparations, analyze the samples with different methods and finally draw conclusions from these activities. An important fact is that the hazard waste was removed from the WEEE stream as a first step, required by law. High value products were also removed from the WEEE-stream early in the recycling chain, such as laptop screens, cables and especially PCB (Printed Circuit Boards), and they are omitted in this work.

Fine-grained fractions in focus

The rest continues to the recycling process, and the outputs consist of several materials in different particle sizes. There are some outputs consisting of fine materials, and these are in focus in this project, since some of the precious metals tend to end up in these categories.

The project has also gathered know-how in the literature and from other industrial sectors, as well as a description of the present market situation for recycling of precious metals and REE.



False-color image in secondary electron mode from scanning electron microscopy of a 6 µm wide gold particle in WEEE. *(© Glenn Bark)*

Different stages of the recycling process

Samples were taken from Stena Technoworld's site in Halmstad.

Three different types of fines were sampled: NF-fines (non-ferrous), Fe-fines (ferrous) and sludge. These three types of material drop out at

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different stages of the recycling process. A sieving process resulted in three sortings, ending up with nine different samples. These samples were casted to epoxy mounts, and further processed to be suitable for examination with a SEM (Scanning Electron Microscope) microscope.

2 821 particles were examined

The samples were examined in the SEM microscope by manually scanning the surface of the mounts. In total, the 2821 particles that were studied in detail, 82 of them included: gold (16), silver (24) or REE (42). However, the number of particles was too low to make any solid conclusions on commonly occurring shape, particle size or presumed origin of the particles. For that many more samples have to be analyzed.

An analysis of the total content of precious metals was also done as a complement to the SEM-analysis. A lot of precious metals were detected and the highest total content of gold was found in the NF-fraction.

Price change might increase recovery

From the few particles of gold that were found, it is clear that they all have odd shapes, not the thin films you would expect coming from use in electronic equipment. This suggests that shredders and other process equipment have liberated the material in a rough manor.

As might be expected a lot of REE containing particles was also found in the fines fractions. However, the economic incentive for REEs' recovery is still very low. Unless there are regulatory or price changes, status quo is expected.

Project facts

Project name: Precious Metals in Waste Material

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