Metallurgical Challenges in WEEE Recycling

ANDREAS LENNARTSSON, CAISA SAMUELSSON, THEO LEHNER

Luleå University of Technology and Boliden Mineral AB, Sweden

Abstract

The main route for industrial recovery of metal and mineral products from metal rich fractions of WEEE is pyro-metallurgy. Smelters such as Boliden have since long been in the field of recycling of electronic scrap. Here we report on some challenges that arise due to the specific nature of e-scrap; change in composition due to change in products and change in composition due to developments in the field of pre-treatment. These changes illustrate also the fact that there is still room for improvement of communication channels between the OEM's and the recyclers, but also between the industrial and academic recyclers. Pyro-metallurgical recovery follows the line; charge preparation, reducing smelting, phase separation, (copper) converting and electro-refining, and (slag) refining. A challenge in the metallurgy of recycling complex feed is the formation of various phases:

1. Coexistence of speiss, matte, slag and gas,
2. Coexistence of pig iron, copper bullion, slag, gas and
3. Coexistence of slag phases.

Similar challenges may face the operator of the sampling department, as varying fractions of coexisting phases may lead to sampling errors. Here experience comes well into the picture.

Although modelling will not solve all problems connected with metallurgical processes, it can be a good tool when used in combination with industrial experience to describe slag chemistry, element distribution etc. There are two great challenges when using thermodynamic for process simulation. Data used must be valid and evaluated for the actual composition range and the reactions should not be controlled by kinetics. In most pyro-metallurgical processes the temperatures are high enough to assume that equilibrium will be reached. However this is not true for all situations.

The flow-sheeting tool SimuSage, which is based on ChemApp and its rigorous Gibbs energy minimization routine, together with the extensive collection of thermodynamic data from FactSage is used to simulate the mass and heat balances for various process units. A model for the copper converter has been constructed and verified against plant data. The non-equilibrium conditions are dealt by dividing the converter into segments. Equilibrium conditions are assumed to be reached within each segment and concentration and/or temperature gradients exists between the segments. The result so far is in good agreement with plant data, which will be demonstrated in the presentation.