Phosphorus in Slag and Modelling of the RecoPhos Process

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ABSTRACT

Natural phosphate sources low in heavy or radioactive metals are getting scarce. Containing about 15% of P_2O_5, and produced in large volumes, sewage sludge ash can be considered the most promising secondary P-source. In the *RecoPhos project*, a European consortium studies an innovative approach to recover phosphorus from ash coming from sludge mono-incineration.

The RecoPhos process is a thermal process using an InduCarb reactor and a basic chemical principle similar to the Wöhler process (submerged arc furnace for phosphorus production). The InduCarb reactor is an inductively heated packed coke bed reactor, designed for treated dusts, such as steel works (EAF) dust.

Here, the process will reduce phosphorus oxide from the sludge ash; the elemental phosphorus is then evaporated and condensed to white phosphorus or high grade phosphoric acid. Further products will be a slag, a highly calorific gas and potentially a heavy metal concentrate.

InsPyro is currently building the thermodynamic databases and process models necessary to predict the process behaviour with different feeds with varying phosphorus sources, reductants, and potentially fluxes.

In this presentation, we will show the progress on the binary phase diagrams and the integration with existing databases available from GTT. The associate model is used for the liquid oxide. Except for a few systems (e.g. $CaO\text{-}P_2O_5$), the experimental data available is scarce and mainly limited to phase diagram data at lower P_2O_5 content.

On the process modelling, first estimations indicate that the higher iron content of the ash as compared to the natural phosphates will pose a challenge for efficient production, due to the potential formation of ferrophosphorus instead of gaseous phosphorus.

Further, resulting differences in slag chemistry may allow to reduce the required amounts of fluxes, but will also affect melting temperature and viscosity of the slag.