The concept and use of KilnSimu

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Abstract

Rotary kilns are common separator reactors in the mineral processing, metallurgical and chemical industries. The most known are pigment and cement manufacture, as well as the lime calciner in the recovery cycle of the chemicals in the pulp process.
Most of the kilns operate in the counter-current fashion where the condensed raw material is fed into the kiln from the other end than the hot gas that is used to heat the material.
There is increasing interest in the chemistry of the rotary kilns, as many of the raw materials as well as the fuels used as heat sources vary in their chemical composition.

KilnSimu is a specialised application based on the general concept of ChemSheet, the EXCEL Add-in for thermochemical applications. It provides the user on the one hand with a dedicated interface that permits input for heat transfer data, input amounts of materials, rotational speed etc. and on the other hand it uses for a set of selected equilibria either the general complex equilibrium concept or even the possibility to incorporate kinetic inhibitions, i.e. constrained equilibria. All thermodynamic calculations are executed by way of calls to ChemApp.

The application of KilnSimu is discussed for two different cases, the rutile production from TiO(OH)2 and a cement clinker. The former case incorporates the explicit use of reaction kinetic data while the later case shows how the rotary kiln concept can be augmented by additional pre- and/or post-kiln stages.