International Conference on
Metal, Mining and Magnetic Materials

November 01-02, 2018
Paris, France

Bernhard Peters et al., J Mat. Sci. 2018, Volume:6
DOI: 10.4172/2321-6212-C7-031

THERMAL PROCESSING OF RAW MATERIALS BY THE EXTENDED DISCRETE ELEMENT METHOD (XDEM)

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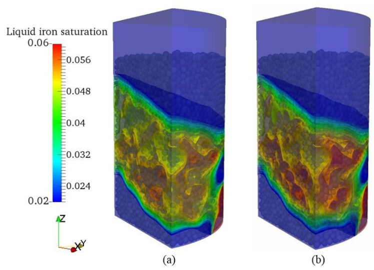
Thermal processing remains the most important method to process materials of any kind in particular raw materials such as iron ore or hard metal powders and the scale of the industry is enormous. Owing to the large scale, manufacturing industries are obliged to design and perform their production both perfectly and optimized under sustainable constraints. In general, processes for thermal treatment are complex and most likely involve various aspects of thermodynamics, fluid dynamics, chemistry and physics that are tightly coupled in space and time. In order to unveil the underlying physics, the innovative approach extended discrete element method (XDEM) was developed and is applied to the iron making in a blast furnace as shown in fig 1 and the reduction of tungsten oxide. The solid phase consisting of particles is treated in a Lagrangian framework so that the thermodynamic state of each individual particle is determined. The flow within the void space between the particles is described by advanced computational fluid dynamics (CFD) that estimates temperature, velocity and composition of the gas phase. Both, gas and solid phase are coupled through an intensive exchange of mass and heat. Both applications, reduction of iron ore and tungsten oxide revealed a very good agreement between experimental data and predictions. Non-uniform flow distributions led to reduced reduction performance due to insufficient amounts of the reducing agent. Hence, the presented numerical XDEM platform serves as an excellent tool to identify deficiencies for design and operation



Biography

Bernhard Peters has completed his Graduation in Mechanical Engineering (Diplom-Ingenieur) and PhD in Behavior of a 3-way catalyst during transient engine operation. From Technical University of Aachen. He is currently the Head of the Thermo-/Fluid dynamics section at the University of Luxembourg and an Academic Visitor of the Lithuanian Energy Institute (LEI). After completing his Post-doctoral Research at Imperial College of Science, Technology and Medicine, University of London, UK, he established a research team dedicated to thermal conversion of solid fuels at the Karlsruhe Institute of Technology (KIT) and worked hereafter in industry at AVL List GmbH, Austria. His research activities at the University of Luxembourg include thermo/fluid dynamics in particular multiphase flow, reaction engineering, numerical modeling, High performance computing (HPC) and all aspects of particulate materials such as motion and conversion for which he developed the extended discrete element method (XDEM).

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