## Dr. Enno Zinngrebe (Tata Steel)





## Ph.D. (1998), University of Göttingen

Thesis: The Inagli Dunite, Siberia: an example of metasomatic effects of alkaline silicate melts in peridotites

_	_	

2005-present

2003-2005

2001-2002

1998-2000

Principal Researcher, Microstructure and Surface Characterization Group,
Ceramics Research Center, R&D Tata Steel Europe
Contract researcher in microscopy, microanalysis and image analysis application at Corus RD&T
Guest stay at Institut fuer Erdwissenschaften, Ernst Moritz Arndt Universitaet Greifswald
Junior Lecturer at the Institute of Geochemistry, Department of Earth Sciences,
University of Utrecht, The Netherlands



- Development of automated inclusion (NMI) analysis in steel and its application to secondary metallurgy,
- Causes and mechanisms of Clogging during Continuous Casting of steel
- Liquid Steel-Refractory interactions, involving both carbon-free and carbon-bonded refractories
- Slag-scale interactions with as-cast slab surfaces and structural and microchemical evolution of surface and subsurface defects
- Currently leading the Steelmaking/Continuous Casting Research Cluster in the MSC group.



## 2017 Fall Semester GIFT Seminor

Time:Nov. 23rd 4:30~5:45pmLocation:GIFT Auditorium #101Speaker:Dr. Enno Zinngrebe<br/>(TATA Steel)Host:Prof. Youn-Bae Kang

http://gift.postech.ac.kr

## The use of non-metallic inclusions in steel as sensor particles for liquid steelmaking: Emerging concepts and applications

The science of steelmaking has progressed considerably since the beginnings. The thermodynamics of the important chemical systems and reactions during primary and secondary steelmaking are well understood, and efforts to develop comprehensive thermodynamic databases with predictive power have reached high maturity. At this point, progress in the process science of steelmaking often comes from the realization that many of the key features of our processes depend not so much on bulk-system scale thermodynamics and equilibration, but rather on very transitory disequilibrium reaction paths in the microenvironments of interfaces between reacting systems. This is illustrated using two examples: one is the mechanism of Ca treatment, a processing step during secondary steelmaking, and the other is the formation of unexpected structures and phases at the inner surface of the SEN during casting. In the case of Ca treatment, while the overall process moves towards equilibrium at large (ladle) scale in the long run, the initial reaction steps and products are controlled by steel-vapor phase interface dynamics in the Ca bubble plume, which are not captured by naïve bulk step equilibration models. Similarly, in the SEN during casting, real conditions develop towards very low vapor phase pressures as the SEN is an undersigned open-system reactor in which carbothermic reaction never can reach equilibration. Consequently, supposedly stable refractory mixes become destabilized at very low vapor pressures, creating a risk of runaway refractory breakdown and other operational risks for casting stability and as-cast steel quality. The steelmaking of the future will have to engineer these interface-controlled processes at the appropriate microscale. Significant process improvements can be expected from such dedicated engineering.