Prof. Seong-Gyoon Kim (Kunsan Nat'l Univ.)

Ph.D. (1987) in Metallurgical Engineering, Seoul National University
Dissertation title: Nucleation and growth of crystals in Fe-Ni-P-B and Fe-Si-B metallic glasses

1999. 03. - present: Professor
Department of Material Sciences and Engineering, Kunsan National University
1992. 03. - 1999. 02: Associate professor
Department of Material Sciences and Engineering, Kunsan National University
1988. 03. - 1992. 02: Assistant professor
Department of Material Sciences and Engineering, Kunsan National University

- crystal growth experiment, theory and simulation
- thermodynamics and kinetics of interfacial mobility
- steel phase transformation theory and simulation

POSTECH GIFT
Graduate Institute of Ferrous Technology

2018
Spring Semester
GIFT
Seminar

Time: May 3rd 4:30~5:45pm
Location: GIFT Auditorium #101
Speaker: **Prof. Seong-Gyoon Kim (Kunsan Nat'l Univ.)**
Host: Prof. Chang Hee Yim

http://gift.postech.ac.kr

Diffuse interface modeling of diffusional phase transformation

Predicting the microstructure evolution during phase transformation in alloys has long been a dream of materials designers. Realizing this dream requires the development of accurate and efficient tools for computer simulations. Recently, the phase-field model has been increasingly used as a powerful computational tool for the prediction of microstructure formation. This model adopts a diffuse interface approach, where the phase state changes gradually from one phase into another across an interfacial region with a finite width. Any point within the interfacial region is assumed to be a mixture of the two phases, whose fractions vary gradually from zero to one across the interface. All the thermodynamic and kinetic variables then are assumed to follow the relevant mixture rules. Though the PFM was originally devised for studying dendritic pattern formation during solidification of pure undercooled melts, it was quickly extended to modeling alloy solidification, grain growth, Ostwald ripening, solid-state phase transformation, multiphase transformations and multicomponent transformations in alloy systems with arbitrary phase diagrams. This lecture consists of following three parts. In the first part, we briefly review the development history of diffuse interface concept, focusing on the classical works by Gibbs, Vander Waals, Hillert and Cahn. In particular, we look into the key concepts of the Hillert's approach on the austenite/ferrite interface, because it is the first step toward understanding the phase transformations in steel alloys. We then demonstrate three selected simulations related with steel alloys, such as 1) early stage solidification of continuous casting in steels, 2) abnormal grain growth induced by grain boundary segregation and 3) solidification and texture evolution in hot-dip galvanization. Finally we introduce some interesting applications of the phase-field models outside of the phase transformation: cell dynamics in biophysics, crack propagation and structure optimization.