Title: Deformation mechanisms of advanced alloys for automotive applications

Abstract

There is a critical need for developments of high specific strength automotive materials for increase of fuel efficiency, decrease of greenhouse gas emission and passenger safety. Lightweighting of automotive materials can be achieved by two concepts, i.e. advanced high strength steel and light alloys such as magnesium (Mg) alloys. The first part of the presentation will focus on the deformation mechanisms and mechanical properties of high Mn twinning-induced plasticity (TWIP) steel. The in-depth microstructural analysis and constitutive modeling reveal that TWIP steel exhibits deformation twinning as the main deformation mechanism in addition to dislocation glide. The effect of SFE on the deformation mechanisms and mechanical properties will be discussed for Fe-xMn-0.6C-yAl TWIP steel. In the second part of the presentation, the phase transformation and deformation mechanisms of Mg alloys with long period stacking ordered (LPSO) structures will be discussed. A systematic atomic scale analysis of the structural evolution of LPSO structures shows that various metastable LPSO structures are involved during heat treatment of $Mg_{97}Y_2Zn_1$ alloy. In addition, deformation mechanisms of cold-rolled $Mg_{97}Y_2Zn_1$ alloy will be discussed for both the α-Mg matrix and the interdendritic LPSO phase. The interdendritic LPSO phase is found to deform either by kink-banding or by the formation of dislocation wall. The α-Mg matrix deforms by basal <a> slip and pyramidal <c+a> slip. The soft α-Mg matrix strengthened by LPSO precipitates and harder interdendritic LPSO phase contribute to the mechanical properties of Mg-LPSO alloys.

Biography

Jin-Kyung Kim is currently a postdoctoral research associate in the Graduate Institute of Ferrous Technology (GIFT) at Pohang University of Science and Technology (POSTECH), Korea. His main research interests include the physical metallurgy of structural materials and the applications of transmission electron microscopy (TEM). He worked as an Alexander von Humboldt fellow at Max Planck Institute for Iron Research, Germany. He holds a BS from Seoul National University, Korea, MS and PhD degrees from POSTECH, Korea.