SEMINAR SERIES

CHALLENGES IN COATED ADVANCED AND ULTRA-HIGH STRENGTH STEELS FOR AUTOMOTIVE APPLICATION

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Lawrence Cho received B.S. degree in Materials Science and Engineering from Pohang University of Science and Technology (POSTECH), South Korea. He received his M.S. and Ph.D. degrees from Graduate Institute of Ferrous Technology, POSTECH. Since 2017, he has been working as a postdoctoral researcher at Advanced Steel Processing and Products Research Center, Colorado School of Mines. His research focused on the physical metallurgy of coated, advanced high- to ultra-high strength steels. During his Ph.D. studies and postdoctoral appointments, he was involved in the University-Industry collaborative research programs with a strong focus on the application of fundamental steel science to the practical challenges related to the development of these new and advanced materials for the automotive industry.

The advanced and ultra-high strength steels (A/UHSS) represent an increasing percentage of steels being used for the production of automotive body-in-white. The main driver for this development is the need to increase passenger safety, lower greenhouse gas emissions, and improve gas mileage. There are, however, several challenges in the utilization of these steels for the automotive industry. The requirement of a high strength has led to concerns about hydrogen embrittlement because steels, in general, become more sensitive to hydrogen-induced cracking as their strength is increased. It was found that an unfavorable combination of thermodynamic properties, hydrogen solubility, and hydrogen diffusivity of a coating system may promote hydrogen embrittlement. Another challenge is that the relatively high alloying levels of Mn, Si, and Al in A/UHSS result in the surface selective oxidation that causes the deterioration of the coating quality of the Zn and Zn-alloy coated A/UHSS. Furthermore, the Zn and Zn-alloy coated A/UHSS are sensitive to the Zn-assisted liquid metal embrittlement (LME). This has led to concerns about the consequences of Zn-assisted LME cracking of resistance spot welds occurring during the assembly of the body-in-white of passenger cars. The present work addresses practical solutions to the challenges related to the application of these new and advanced materials for the automotive industry.

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