The influence of Cr on the electrochemical corrosion and scale formation behavior of high Mn steel in a sweet environment

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The high manganese (Mn) steel containing 15~30 wt% Mn exhibits superior mechanical performance of high strength and good impact toughness. For this reason, the steel has been regarded as one of the promising materials for a variety of industrial applications such as pipe steel used in oil and gas industry. However, high Mn content makes the steel susceptible to corrosion in a sweet environment, which is closely associated with the property of scale formed on the steel. Nevertheless, the effect of Mn or other alloying elements on the electrochemical corrosion behavior in the environment has not been clearly understood.

In this study, by employing various electrochemical analytic tools such as potentiodynamic polarization and electrochemical impedance spectroscopy, the corrosion behavior of three different steels is evaluated in a sweet environment with respect to Mn content and Cr addition. In addition, focused ion beam (FIB), field-emission scanning electron microscopy (FE-SEM) and transmission electron microscopy (TEM) are also utilized for presenting the cross-sectional observation of corrosion products formed on the steel surface. Based on the results, the exact relationship among the addition of 3wt% Cr, scale formation behavior, and electrochemical corrosion resistance in a sweet environment will be clearly established in this presentation.