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Corrosion and Microstructural Properties of Vanadium-Microalloyed High-Manganese Steels

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Abstract : Low resistance and delayed fracture to corrosion, especially in harsh environmental conditions, often limit the wide application of high-manganese (high-Mn) steels. To address this issue, the present work investigates the influence of microalloying on the corrosion properties of high-Mn steels. Microalloyed and base high-Mn steels were synthesized through an arc melting process under an argon atmosphere. To generate different microstructures, the temperature and duration were varied via thermal homogenization treatments. The electrochemical impedance spectroscopy (EIS) and potentiodynamic polarization techniques were used to determine the corrosion properties in 0.6 M NaCl aqueous solution at room temperature. The relationship between the microstructures and corrosion properties was investigated via Scanning Kelvin Probe Microscopy (SKPFM), energy dispersive X-ray spectroscopy (EDX), and Scanning electron microscopy (SEM) techniques. The local corrosion properties were investigated via in situ atomic force spectroscopy (AFM), considering the homogenization treatments. The results indicate that microalloying is a successful technique for enhancing the corrosion behavior of high-Mn steels. Compared to other alloying elements, Vanadium has shown improvement in corrosion properties for both general and local corrosion in chloride environments.

Keywords : corrosion, high-manganese steel, homogenization, microalloying, vanadium
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