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Research of Hydrogen Embrittlement Behavior in Alloy Steels

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Message from the Guest Editor

The ingress of hydrogen into the microstructure of steel alloys may create severe failure. This failure decreases the ductility and strength of steel. This problem arises due to the small size of hydrogen atoms, which enables them to diffuse through different microstructural defects. In the hydrogen-enhanced decohesion theory, the hydrogen atoms diffuse through different defects and weaken the interatomic bonds leading to a break of atomic binding to start slipping. Finally, according to hydrogen-enhanced localized plasticity theory, the mobility of dislocations is increased in the presence of solute atoms, leading to a decrease in the required stress for dislocation movement. In steel alloys suffering from hydrogen embrittlement, both intergranular and transgranular cracks are observed, and these steels show fractures, which are far below the non-affected steels yield strength. The level of hydrogen embrittlement in steel alloys depends on various factors such as steel microstructure, the distribution of inclusions and precipitates, the density of hydrogen traps and dislocations, grain size, residual stress, and crystallographic texture.

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Message from the Editor-in-Chief

Metallic materials play a vital role in the economic life of modern societies; contributions are sought on fresh developments that enhance our understanding of the fundamental aspects related to the relationships between processing, properties and microstructure – disciplines in the metallurgical field ranging from processing, mechanical behavior, phase transitions and microstructural evolution, nanostructures, as well as unique metallic properties – inspire general and scholarly interest among the scientific community.

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