

Hydrogen Embrittlement Properties of the Hot Stamped Carbon Steels

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Abstract : The effects of microstructural characteristics on the mechanical and hydrogen embrittlement properties of 1,800MPa grade hot stamping carbon steel were investigated experimentally. The tensile strength increased with increasing the hot stamping temperature until around 921°C, but that decreased with increasing the temperature in more than 921°C due to the increment of the size of lath martensite and prior austenite. With the hot stamping process, internal strain was slightly created in the sample, which led to the slight increment of the hardness value although no clear change of the microstructural formation was detected. Severity of hydrogen embrittlement was investigated using the hot stamped carbon steels after the immersion in a hydrogen gas, and that was directly attributed to the infiltration of the hydrogen into their grain boundaries. The high strength carbon steel with tiny lath martensite microstructure could make severe hydrogen brittleness as the hydrogen was strongly penetrated in the grain boundaries in the hydrogen gas for a month. Because of weak embrittlement for the as-received carbon (ferrite and pearlite), hydrogen embrittlement is caused by the high internal strain and high dislocation density. The hydrogen embrittlement for carbon steel is attributed to amount of the hydrogen immersed in-between grain boundaries, which is caused by the dislocation density and internal strain.

Keywords : hydrogen embrittlement, hot stamping process, carbon steel, mechanical property

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