

Characterization of Carbonitrided and Oxidized Layers on Low-Carbon Steel by Conversion Electron Mössbauer Spectrometry, X-Ray Diffractometry, and X-Ray Photoelectron Spectrometry

*K. KUROSAWA**⁽¹⁾

*H.-L.Li**⁽²⁾

*Y. UJIHIRA**⁽²⁾

*K. NOMURA**⁽³⁾

Abstract

The structures of low-carbon steel oxidized in an aqueous saline bath at 403 K and a fused salt bath at 673K after carbonitriding were studied using conversion electron Mössbauer spectrometry (CEMS), x-ray diffractometry (XRD), and x-ray photoelectron spectrometry (XPS). Only a doublet peak caused by poor crystallinity of iron oxyhydroxides (FeOOH) or fine particles of iron oxides such as magnetite (Fe₃O₄) and maghemite (γ -Fe₂O₃) was detected in the CEMS spectra of the surface of the carbonitrided steel oxidized in the aqueous saline bath. Corrosion resistance of the carbonitrided specimens was increased by oxidizing. The oxidized layers produced in the aqueous saline bath were superior to those produced in the fused salt bath as a result of pores in the carbonitrided zone being filled with finer particles of iron oxides and the production of tight, thick oxide layers of amorphous iron oxyhydroxides or fine iron oxides. Deformation of iron nitride (γ -Fe₄N) crystals in the carbonitrided zone could not be detected by oxidizing in the aqueous saline bath but were detected in the fused salt bath at 673 K.