Relationship between Stress-Corrosion Cracking and Strain Rate in Alpha Brass*

Michinori TAKANO

The Research Institute for Iron, Steel and Other Metals

Abstract

Stress-corrosion cracking of Cu-30%Zn alloy under the constant strain rate in the range of $6.6\times10^{-6}\,s^{-1}$ to $1.1\times10^{-2}\,s^{-1}$ was investigated in Mattsson's solution (pH 7.2) (for intergranular cracking) and in 1 M/L NH_4OH+0.25 M/L $CuCl_2$ aqueous solution (pH 11.0) (for transgranular cracking). Within strain rates of $6.6\times10^{-6}\,s^{-1}$ for intergranular cracking and of $1.1\times10^{-5}\,s^{-1}$ for transgranular cracking, the rate-controlling step of stress-corrosion cracking corresponds to the slip step formation. Exceeding the above strain rates the s c c is controlled by the corrosion, where the rate-controlling mechanism requires the activation energy of about 18.7 Kcal/mol. When the strain rate exceeds $1.1\times10^{-3}\,s^{-1}$, intergranular s c c never occurs at room temperature. Width of crack tip increases with increase of strain rate for intergranular cracking, while decreases for transgranular cracking.

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