알루미늄의 첨가와 열처리가 연강의 응력부식성질에 미치는 영향

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The Effect of Al Addition and Heat Treatment on the Stress Corrosion Behaviour of Mild Steel

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ABSTACT

The effects of Al addition and heat treatment on the stress corrosion behaviour of mild steel (0.03~0.04%) in the aqueous solution containing 860g $Ca(NO_3)_2$ $4H_2O$ and 30g NH_4NO_3 per liter of solution was studied at the boiling temperature (11°C) using constant strain method (U-bend specimen). The resistance to SCC (stress corrosion cracking) of mild steel was studied with various Al contents of 0%, 0.04%, 0.45%, 0.65%, 0.96, 1.28% and 1.52% by weight after annealing at 1150°C for 1h, then furnace-cooled to room temperature. The effect of heat treatments (furnace-cooled, oil-quenched, water-quenched, and water-quenched then tempered at 500°C for 1h) on the resistance to SCC was studied with the specimens of 0.04% and 0.45% Al content.

Induction period, crack propagation period and rate were determined by extrapolation of measured maximum crack depth at different exposure time to the corrosive environment. In this study induction period and crack propagation rate are considered to be the measure of resistance to SCC of mild steel.

All specimens showed 1 or up to 3 crack on an U-bend specimen which propagated along grain boundary (intercrystalline SCC). For furnace-cooled specimens the resistance to SCC increased as Al content increased from 0% up to 0.65%, then decreased up to 1.52% Al. The two staged variation of the resistance to SCC in mild steel was discussed in terms of tendency of Al nitride formation and grain size of specimens respectively. Tempered specimens with Al contents 0.04% and 0.45% showed higher resistance to SCC than water-quenched and this is considered to be due to the decrease in carbon concentration at the grain boundary.