

MFM observation on thermal sensitization of Ni-Cr-Fe alloys

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Alloy600, austenitic Ni-Cr-Fe alloy, has a high corrosion resistance and has been used in steam generators in nuclear power plants. However, thermal treatment including welding during construction causes chromium carbide precipitations and chromium depletion at the grain boundary [1]. This phenomenon is called thermal sensitization, and it is a serious problem because it leads to lower the corrosion resistance. Alloy600 is normally non-ferromagnetic at room temperature. However, a change of chemical composition during the sensitization may cause a ferromagnetic transition of Alloy600. We have investigated magnetic properties of thermally sensitized Alloy600 by using magnetic force microscopy (MFM). After thermal treatment at 873K, precipitation of chromium carbides was confirmed at the grain boundary by SEM image and ferromagnetic contrast was observed along the grain boundary in MFM images (Fig. 1). Magnetic properties of ternary model alloys suggested that the chromium depletion occurred in the vicinity of carbides leads to raise the Curie temperature of Alloy600 near the grain boundary. This study shows a possibility for the application of magnetic non-destructive evaluation of the sensitization of Alloy600.

1. E. L. Hall and C. L. Briant, Metall. Trans. A, 16A (1985) 1225.

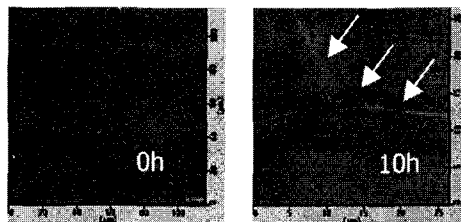


Fig.1. MFM images of Alloy600 heat-treated at 873K for 0h and 10h.