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Abstract

To make clear the origin of the Invar property, some physical properties of *fcc* (Fe_{1-x}Co_x)_{0.89}Cr_{0.11} alloys which are most typical Invar alloys in the Fe-Co-Cr system (Stainless Invar) have been studied so far. In the present experiment, the temperature and composition dependences of thermal expansion for the alloys were measured and the following results were obtained:

It has been ascertained that these alloys have the same remarkable Invar characteristics as reported by Masumoto. Thermal expansions measurements at sufficiently high temperatures made it clear that the Invar property is caused by the effect of the spontaneous volume magnetostriction in the temperature range below the Curie point of short-range magnetic ordering. And the spontaneous volume magnetostriction at 0°K has been estimated from the normal thermal expansion curves (only lattice vibration), compared with thermal expansion of Ni. The value obtained on an alloy of $x=0.6$ was $12 \pm 1 \times 10^{-3}$, about three times greater than that for Fe-Ni Invar alloys.

The microscopic mechanism or the cause of this large spontaneous volume magnetostriction may be ascribed to (1) the magnetic mechanism due to the characteristic electronic state of Invar alloys and (2) the elastic mechanism due to peculiar lattice properties of Invar alloys associated with the $\alpha \rightleftharpoons \gamma$ martensitic transformation process which is common in each system having the Invar region.

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