Composition, Temperature, and Ordering Dependence of Magnetostriction Constants in Nickel-Manganese Alloys

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Abstract

Magnetostriction constants, λ_{100} and λ_{111}, in the state quenched from 700°C of nickel and 3.1, 7.0, 14.2, 18.7 and 25.1 at.% Mn-Ni alloys and those in well-annealed state of 25.1 at.% Mn-Ni alloy have been determined in the temperature range between room and liquid air temperatures. In the quenched state, both constants decrease in magnitude roughly monotonically with increasing Mn content in this temperature range. It seems, however, that each of the magnetostriction constants vs. composition curves at temperatures near liquid air temperature has an inflection point at about 5 at.% Mn. The temperature dependence of the magnetostriction constants in the quenched state is roughly the same irrespective of the composition. A well-annealed Ni_3Mn alloy has fairly large negative magnetostriction constants, which decrease in magnitude rather rapidly with rising temperature, suggesting the occurrence of the change in their signs well below the Curie temperature. The composition dependence of the magnetostriction constants in disordered Ni-Mn alloys and the magnitude of the magnetostriction constants of an ordered Ni_3Mn alloy are discussed in terms of atom pair interactions, of which the magnitudes are assumed to depend on the atomic magnetic moments.

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