【S-17】

Peculiar Magnetic and Optical Properties of Ni3Al Alloys and NiAl Alloy Films

김진배,[1] 김기원,[1] Y. V. Kudryavtsev,[2] 이주열,[3] 박주상,[4] 이영백[4]
[1]선문대학교 물리학과
[2]Institute of Metal Physics, NAS of Ukraine, Kiev, Ukraine
[3]호서대학교 물리학과
[4]한양대학교 물리학과

Recently, the electronic structures, the physical properties and the thermal stability of 3d transition-metal (TM) aluminides, in connection with peculiarities of their crystalline structures, have been a focus of many investigations. In case of the disordered and/or the off-stoichiometric alloys, appearance of the so-called antistructure TM atoms (the TM atoms at the Al sites) can change the local environment in these alloys and leads to noticeable changes in the electronic energy structures (EES) and hence in the physical properties. In this study, the peculiar magnetic and optical properties of two Γ'-phase Ni_3Al alloys ($Ni_{0.752}Al_{0.248}$ and $Ni_{0.771}Al_{0.229}$) and *B2*-phase $Ni_{0.50}Al_{0.50}$ alloy films (both ordered and disordered states) have been investigated. The disordered $Ni_{0.50}Al_{0.50}$ alloy films were prepared by using the vapor-quenching deposition onto substrates cooled by liquid nitrogen. The compositions and structures of specimens were studied by using x-ray fluorescence and x-ray diffraction, respectively. The temperature dependence of magnetic properties of the ordered and disordered $Ni_{0.50}Al_{0.50}$ alloy films were investigated in the 10 - 293 K temperature range by Faraday balance, and at fixed temperatures (78 and 293 K) using ferromagnetic resonance spectroscopy. The magnetic properties of Ni3Al alloys in the 4.2 - 300 K temperature range were investigated by measuring the AC magnetic susceptibility. The optical properties were studied by using spectroscopic ellipsometry at room temperature.

In contrast to the ordered state of $Ni_{0.50}Al_{0.50}$ alloy films a noticeable growth in the magnetic moment was observed below 50 K for the disordered state. In case of Ni_3Al alloys, the AC magnetic-susceptibility measurements reveal two magnetic transitions, one at 87.5 K and the other at 252 K. The observed peculiarities in magnetic properties as well as optical properties

were analyzed in connection with the theoretical calculations based on the tight-binding LMTO-ASA method. The role of the antistructure Ni atoms were also discussed.