CHAPTER IV

CONCLUSIONS AND DISCUSSIONS

The neutron diffraction study on $Ni_{1.55}Mn\ Ge_{0.45}$ confirms that this alloy is in Laves phase, $Mg\ Cu_2$ type structure, with a lattice constant a = 6.762 Å as reported by Yu. V. Kuz'ma et. al[3]. Since the nuclear structure factor of (200) plane is zero, the presence of (200) peak in the diffraction patterns at temperatures below Neel temperature indicates that this peak is a purely magnetic peak which will disappear at temperatures above the Neel temperature. The observed relative intensities of diffraction pattern taken above Neel temperature were in good agreement with the calculated relative intensities deduced from the nuclear intensity of cubic Laves phase, $Mg\ Cu_2$ type structure.

Neutron diffraction patterns at room temperature and 90 K showed that this alloy is an antiferromagnetic material. The magnetic unit cell was found to be equal to the chemical unit cell and the two nearest manganese atoms are coupled antiferromagnetically. The magnetic moment of manganese atoms in this ternary intermetalic compound was found to be 3.6 Bohr magneton at room temperature and 4 Bohr magneton at 90 K. Since $Ni_{1.55}Mn\ Ge_{0.45}$ has a cubic structure, information about orientation of magnetic atoms in the unit cell can not be obtained. Neutron diffraction study of (200) plane at different temperatures showed that the intensity of this peak

decreased as the temperature increased. The Neel temperature of $Ni_{1.55}Mn\ Ge_{0.45}$ was found to be 534 K. However, it should be noted that, the magnetic phase transition temperatures are in general obtained from magnetic susceptibility measurements. Therefore, it is suggested that the Neel temperature obtained in this experiment should be confirmed by magnetic measurement.

It is also suggested that better furnace with smaller temperature gradient along the height of the sample should be used for the determination of the Neel temperature of this material. Single crystal of $Ni_{1.55}Mn\ Ge_{0.45}$ if available for neutron diffraction experiment will give higher intensity for each peak and will result in higher accuracy in estimating the magnetic moment of manganese atom and the Neel temperature of $Ni_{1.55}Mn\ Ge_{0.45}$.