MAGNETIC STRUCTURE OF $FeNi_{1.5}\ Ti_{0.5}\ O_4$ - A NEUTRON DIFFRACTION STUDY

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Abstract

A polycrystalline sample of the compound Fe $Ni_{1.5}\ Ti_{0.5}\ O_4$ was investistigated by means of neutron diffraction in the temperature range 20-500 C. Neutron diffraction patterns have revealed that the Ti^{4+} ions occupy the B-sites in the spinel structure. The magnetic moment per molecule at room temperature shows that the studied compound is a Néel ferrimagent with $m(A) = 3.140 + 0.2\ u_B$ and $m(B) = 4.69 + 0.2\ u_B$. The curie temperature was found to be $T_C = 340 + 5$ C.

Introduction

This work is part of some systematic neutron diffraction studies on polycrystalline samples of the solid-solution $Fe_{2(1-y)}\ Ni_{1+y}\ Ti_y\ O_4$ ($0 \ll y \ll 0.5$), which were obtained by replacing the Fe^{3+} ions in $Ni\ Fe_2\ O_4$ by equal amounts of Ni^{2+} and Ti^{4+}. The principal aim the magnetic measurements carried out on this system was to determine the cation distribution and the Curie temperature and to investigate the influence of the heat treatment on these properties[1]. Further, as far as we know, the mentioned system has never been subjected to an extensive neutron diffraction study. In fact neutron diffraction has a great advantage for studying such system and provide direct information on its structural and magnetic properties. Such advantage arises from the large differences between the scattering lengths of the involved ions. In this paper we report and explain the results of a neutron diffraction studyt on a powder sample of $Fe\ Ni_{1.5}Ti_{0.5}O_4$ (y=0.5).

Experimental

The polycrystalline sample of $Fe\ Ni_{1.5}Ti_{0.5}O_4$ was prepared by the usual sintering method. Well-ground powders of NiO, TiO_2 and α-Fe_2O_3 were mixed under acetone and then fired at 1000°C for 24 hours. The resultant powder was pressed into pellets, fired again at 1200°C for several hours and left to cool slowly.

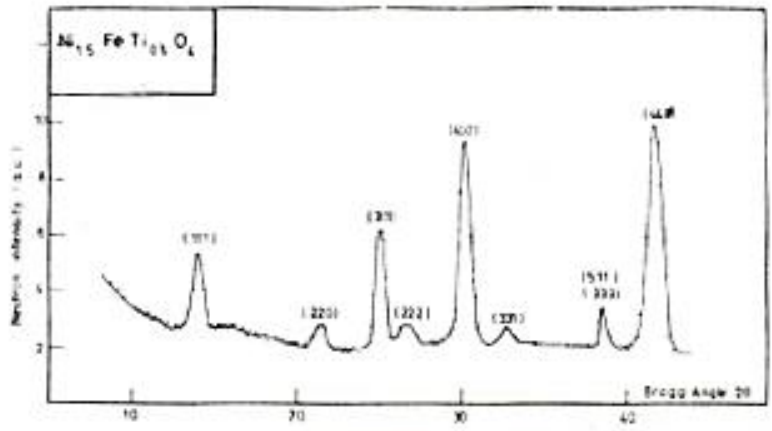

Fig.(1): Neutron diffraction pattern of the sample $Ni_{1.5}FeTi_{0.5}O_4$ at room temperature

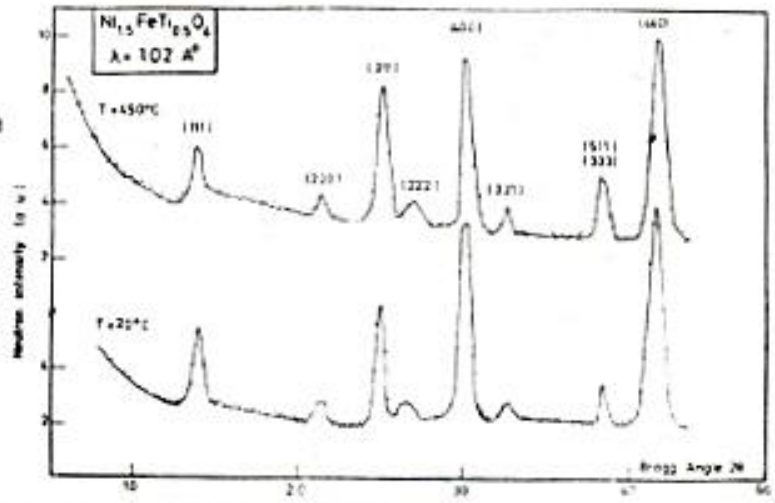

Fig.(2): Neutron diffraction pattern, at room temperature and at T=450°C for the compound $Ni_{1.5}FeTi_{0.5}O_4$

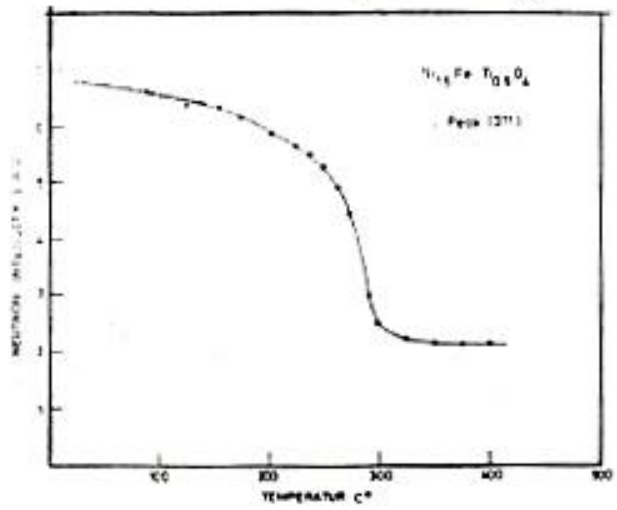

Fig.(3): Variation of intensity of the (311) peak with temperature