

Reinvestigation of the magnetic structure in L10-type MnPt powder samples

Keiichi Ogita, Izumi Tomeno and Yorihiro Tsunoda

School of Science and Engineering, Waseda University, 3-4-1 Ohkubo Shinjuku Tokyo 169-8555

The magnetic structure of MnPt powder samples at room temperature reported by previous authors does not coincide in the spin direction. The early works¹⁻³) reported that the Mn spins are parallel to the c-axis (Type-A). Severin et al, however, reported that the Mn spins are within a c-plane at the room temperature. (Type-B).⁴ Since the MnPt thin films are applied to the pinning of the ferromagnetic sheet in the GMR device, the direction of the magnetic moment around room temperature in MnPt fine particles which have large surface fraction would be significant for both fundamental physics and practical applications.

The MnPt powdered samples were prepared and separated in order of sizes using several sieves into the sample 1 (the diameter $R_1 < 20 \mu\text{m}$), sample 2 ($20 \mu\text{m} < R_2 < 38 \mu\text{m}$), sample 3 ($38 \mu\text{m} < R_3 < 56 \mu\text{m}$), sample 4 ($56 \mu\text{m} < R_4 < 106 \mu\text{m}$) and sample 5 ($R_5 > 106 \mu\text{m}$). Since Severin et al used the maximum particle sizes of approximately $50 \mu\text{m}$, the sample 3 is comparable size with their samples. Neutron scattering measurements were performed at the T1-1 triple axis spectrometer.

What we are concerned here is only the direction of Mn magnetic moments in the c-plane, the type-A or the type-B structures, at room temperature. We can easily distinguish these two types of structures using the intensity ratio of the pure magnetic peaks $I(100) / I(101)$ because of the large tetragonality of the lattice $c/a = 0.915$. After the corrections of the Lorentz factor and the magnetic form factor, the expected intensity ratios for the type-A and type-B structures are 3.10 and 1.04, respectively.

The experimental data obtained for the sample 1 ($R_1 < 20 \mu\text{m}$) and the sample 5 ($R_5 > 106 \mu\text{m}$) are given in Fig.1-a) and Fig.1-b). The ratios of the observed in-

tegrated intensities for the sample 1 and the sample 5 are 3.03 and 3.04, respectively. The ratios for other samples also show the similar values. Thus, all our data support the type-A structure independent of the particle sizes. Since the sample 1 is already far smaller than that of Severin et. al, it is hard to ascribe the causes of the difference to be the size effect or the surface effect.

- 1) A.F.Andresen et al: Philos. Mag. 11 (1965) 1245
- 2) L.Pal et al: J. Appl. Phys. 39 (1968) 538.
- 3) E.Kren et al: Phys. Rev. 171 (1968) 574.
- 4) C.S.Severin et al: J. Appl. Phys. 50 (1979) 4259.

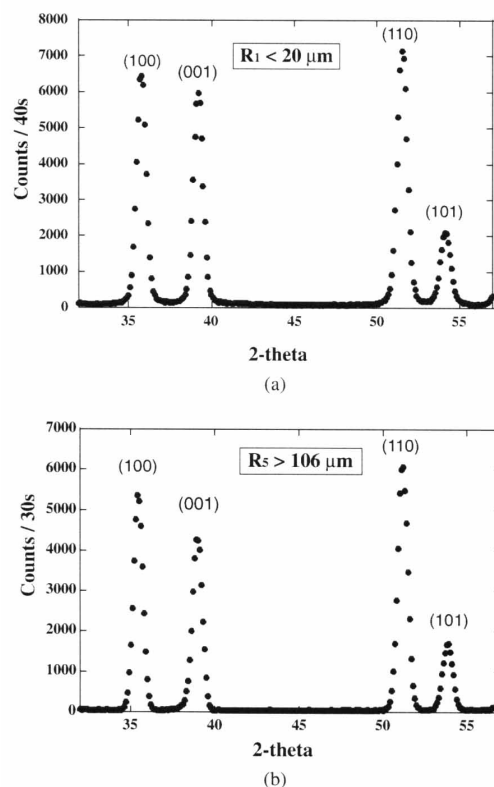


Fig. 1.