Multi-Q magnetic ordeing in the ABC_6-type ordered alloy Pt-Mn

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$Pt_{0.86}Mn_{0.14}$ forms the ABC_6-type atomic ordered structure which has so far been reported only in the binary alloys of Pt-Mn and Pt-Cu, as well as in the ternary alloy $CuMnPt_6$. In the ordered structure, Mn atom locates at $4a$ site of the space grope $Fm\bar{3}m$ and ordered magnetically to type-III antiferromagnetic structure below $T_N = 20K$[1], which is characterized by a propagation wave vector of $k = (1\ \pm 1/2\ 0)$. Above T_N, magnetic diffuse scattering was observed at around $(1\ \pm 1/2\ 0)$ up to $4T_N$ with several incommensurate peaks at $k = (1\ \pm\delta\ 0)$ in the measurement at a disk-chopper-type spectrometer AMATERAS in J-PARC. In order to elucidate the origin of the magnetic diffuse scattering above T_N, we have investigated the detailed temperature dependence of the magnetic reflections in $Pt_{0.86}Mn_{0.14}$ by using a general-purpose triple axis spectrometer GPTAS in JRR-3. In the measurement, the spectrometer was operated in a three-axis mode with a wavelength of 2.663Å by using pyrolytic graphite (002) reflections and a collimation of open -80 ' -80 ' -80 ' -A. As shown in fig.1, multiple peaks are clearly observed in the result at 19K compared to the previous measurement performed AMATERAS. The temperature dependance of these peaks indicates that they converge to the $(1\ \pm 1/2\ 0)$ position below T_N. This behavior suggests the presence of multi-Q short-range magnetic ordering above T_N, which can be attributed to geometrical frustration inherent in the face-centered cubic lattice.

[1] M. Takahashi, T. Sembiring, Y. Noda, T. Shishido and K. Ohshima: Phys. Rev. B **70** (2004) 14431.

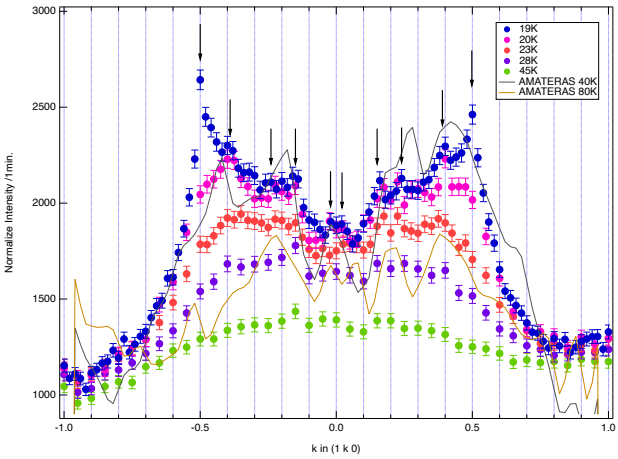

Fig.1: Elastic magnetic scattering of $Pt_{0.86}Mn_{0.14}$ around $(1\ \pm 1/2\ 0)$ positions at various temperatures. The arrows indicate the peaks corresponding to multi-Q magnetic ordering, while solid lines represent the elastic intensity profiles measured at 40 K and 80 K in the previous measurement at AMATERAS.

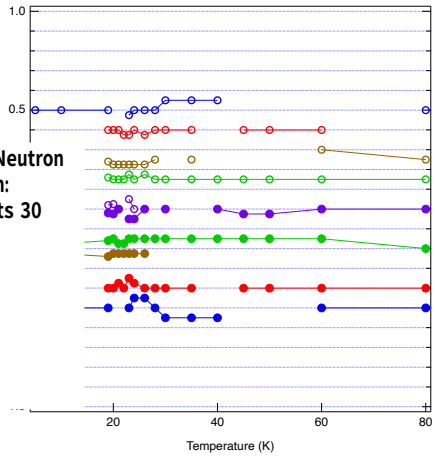

Fig.2: Temperature dependance of the observed peak positions δ at $(1\ \pm\delta\ 0)$.