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Probing the antiferromagnetism in $(Cr_{84}Re_{16})_{100-y}V_y$ alloys using neutron diffraction

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Abstract :

Sommerfeld coefficient (γ), obtained from fitting the low temperature specific heat (C_p) data to the equation $C_p = \gamma T + \beta T^3$, has previously been used to identify the region of critical concentration in $Cr_{1-x}V_x$ [1] and in $(Cr_{84}Re_{16})_{100-y}V_y$ [2] alloys. The effects of spin fluctuations and nature of the nesting bands on physical properties of $Cr_{1-x}V_x$ alloys were explored using specific heat measurements and the corresponding trends in the $\gamma - x$ curve [1]. In the $(Cr_{84}Re_{16})_{100-y}V_y$ alloy system, γ shows anomalous trends close to the critical concentration as well as at $y \approx 4$ [2]. The decrease in γ observed at $y \approx 4$ may correspond to the transition from one magnetic phase to another. At $y = 0$, the alloy system is expected to be in the commensurate spin-density-wave (CSDW) phase [3]. On increasing the V concentration, the incommensurate (I) SDW phase may prevail due to the mismatch between the electron and hole sheets. In order to clarify this conjecture, neutron diffraction studies are proposed. Neutron diffraction is an ideal tool to explore the magnetic phases in an alloy and was successfully used in the $Cr_{1-x}Ru_x$ system to establish the types of antiferromagnetic order in the system [4]. This paper reports on the preliminary results of neutron diffraction on the $(Cr_{84}Re_{16})_{100-y}V_y$ alloy system, with $y = 0$, 4.2 and 6.2. Results indicate that at room temperature, the $Cr_{84}Re_{16}$ alloy is in the CSDW phase. Possible magnetic satellites indicative of the ISDW phase were observed in the alloys with $y = 4.2$ and 6.2 as envisaged. [1] Takeuchi J *et al.*, *J. Phys. Soc. Japan* **49**, 508 (1980) [2] Jacobs B S *et al.*, *J. Appl. Phys.* **113**, 17E126 (2013) [3] Fawcett E *et al.*, *Rev. Mod. Phys.* **66** 25 (1994) [4] Papoular R *et al.*, *J. Magn. Magn. Mater.***24** 106-110 (1981)

Award :

Yes

Level :

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Paper :

Yes

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