

## Abnormal magnetic behaviour in $\text{NpFe}_4\text{Al}_8$

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$\text{UFe}_4\text{Al}_8$  has attracted much attention in the last years due to its unusual properties. However, the  $\text{NpFe}_4\text{Al}_8$  compound has been so far only partially studied. A magnetic structure different from the observed in  $\text{UFe}_4\text{Al}_8$  [1] was proposed from powder neutron diffraction data, with the Fe moments antiferromagnetically ordered and the Np moments ferromagnetic aligned, both along the  $c$  axis [2]. Subsequent ac- and dc-susceptibility, neutron diffraction, and Mössbauer studies lead to the proposal of a low temperature spin-glass state [3]. The higher  $f$ -electron localization in Np, when compared with U, can lead to significant differences between the physical properties of these two isostructural compounds. In order to further elucidate these differences we decided to reinvestigate the  $\text{NpFe}_4\text{Al}_8$ .

Single phase  $\text{NpFe}_4\text{Al}_8$  was prepared by arc-melting. It was confirmed to crystallize in the  $\text{ThMn}_{12}$ -type structure, with the Fe atoms being located only in the  $8f$  sites.  $M(T)$  measurements show a ferromagnetic-

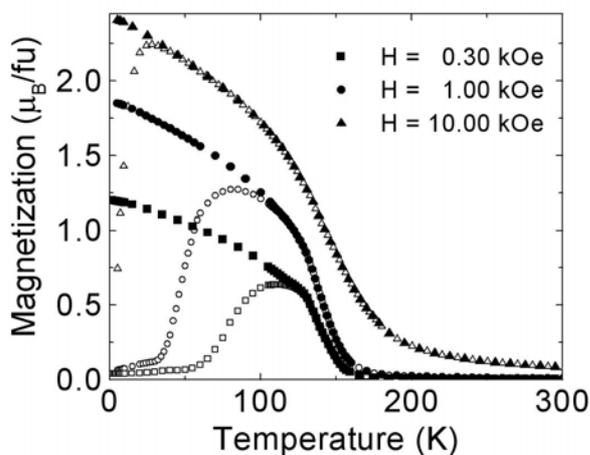


Fig. 1. Temperature dependence of magnetization. type transition at  $T_C=135\text{K}$  and a small anomaly at  $118\text{K}$  (Fig.1).  $T>240\text{K}$

susceptibility follows a Curie-Weiss law ( $m_{\text{eff}}=7.9\mu_B$ ,  $\theta_p=133\text{K}$ ).  $M(H)$  measurements shown a ferromagnetic-type behaviour below  $T_C$ , with a spontaneous magnetization of  $m_S=2.3\mu_B/\text{f.u.}$  at  $2\text{K}$

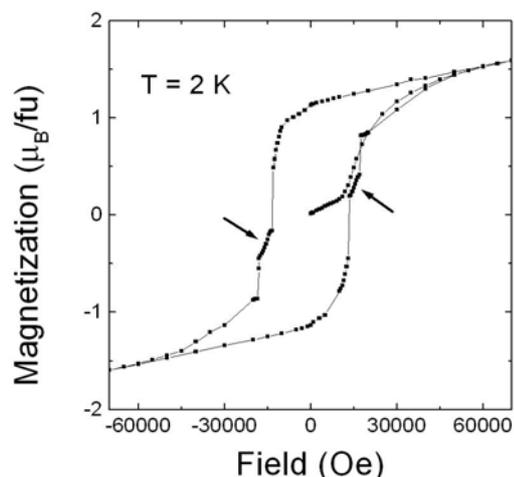


Fig. 2. Hysteresis cycle at  $2\text{K}$ ; the arrows indicate the anomalous step.

In the polycrystalline  $\text{NpFe}_4\text{Al}_8$  material, the low temperature hysteresis cycle is characterized by a step corresponding to a near-zero magnetization value (Fig.2), similar to that previously observed in measurements made on a  $\text{UFe}_4\text{Al}_8$  single crystal.  $\text{NpFe}_4\text{Al}_8$  band structure calculations confirm the tentative conclusions of experimental measurements, which point to a Fe and Np contribution to the magnetic properties of this compound [4].

### References

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