Magnetic order in $PrFe_4As_{12}$ filled skutterudite

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We studied diffraction of polarized neutrons on single-crystal samples of filled skutterudite $PrFe_4As_{12}$. Earlier magnetization study has clearly shown ferromagnetic ordering below 18 K. Isoterms at 2 K have revaled saturated moment of $2.3\mu_B$/f.u. at 5.5 T and a change of easy axis from [100] to [111] above 0.5 T.
Refinement of magnetic structure from polarized neutron flipping ratios unambiguously revealed magnetic moments on both, Pr and Fe sites. Values of Pr moment at 2 K are: 1.55(4), 1.80(5) and $1.84(5)\mu_B$, in fields of 0.3, 2 and 6 T, respectively. Corresponding values of Fe moment are 0.19(1), 0.24(2) and $0.25(1)\mu_B$. These values were obtained assuming collinear ferromagnetic alignment of all moments in direction of applied field. Such assumption was drawn from the 2 K isoterms of magnetization and seems fully justified at least for fields of 2 and 6 T. When the directions of moments were allowed to vary as parameters of the model, the refinement was slightly better and values of the moment were smaller, e.g. for 6 T they were: 1.43(9) and $0.17(2)\mu_B$, for Pr and Fe, respectively, and aligned parallel to a bisection between [111] and [100]. Further releasing of constraints on moment angles (i.e. allowing some non-collinearity in the structure) did not improve the refinement and values of all angles converged very close to those corresponding to the collinear model.

9.7 cm

13.4 cm

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