Local magnetism of YbCrSb$_3$, an anomalous member of the RECrSb$_3$ series

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In recent years, the family of quasi-two-dimensional intermetallic compounds with the chemical formula RECrSb$_3$ (RE=La,Ce,Pr,Nd,Sm,Gd,Tb,Dy,Yb) have been the subject of a number of studies aimed at understanding their magnetic and transport properties. The compound YbCrSb$_3$ is a relatively new member of the RECrSb$_3$ series. A detailed report of its structural, magnetic and electrical properties was first presented in Ref. [1]. YbCrSb$_3$ is isostructural to the other RECrSb$_3$ compounds in the series. However, it appears to show “anomalous” properties. These include (i) a cell volume that is considerably larger than that expected from an extrapolation of increasing atomic number of the RE atom due to lanthanide contraction, and (ii) whereas the Curie temperature $T_c$ in the other RECrSb$_3$ compounds decrease monotonically with increasing size of the RE ion, YbCrSb$_3$ shows a dramatic increase in the $T_c$ that is in fact the highest of all the RECrSb$_3$ materials studied to date. The suggestion is that these differences are a consequence of the Yb being in a divalent charge state while the other RE ions in the series are trivalent.

In this paper, we report $\mu$SR measurements of the local magnetism in polycrystalline YbCrSb$_3$. The experiments in near zero-field show coherent muon spin precession (at $\approx$ 80 MHz at low temperatures), establishing at the local level that a significant fraction of the sample is in a well-ordered, 2D-like, long range magnetic state below $\approx$ 240K. In addition, there is evidence of additional ordered magnetism below $\approx$ 50 K. These studies are compared with the bulk measurements [1], as well as previous $\mu$SR measurements on other selected RECrSb$_3$ compounds, such as RE=La [2].