Magnetic properties of organic-based Ni[TCNE](MeCN)$_2$[BF$_4$] magnet.\textsuperscript{1} KONSTANTIN POKHODNYA, CNSE NDSU, Ohio State University, University of Utah, VICTOR DOKUKIN, JOEL S. MILLER, University of Utah — A new organic-based magnet of Ni[TCNE][BF$_4$](MeCN)$_{2-\delta}$ (1) composition ($\delta = 0.15$; TCNE = tetracyanoethylene) was synthesized via reaction of NBu$_4$(TCNE) and Ni(NCMe)$_6$(BF$_4$)$_2$ in CH$_2$Cl$_2$. Zero field cooled and field cooled magnetizations, $M(T)_{ZFC}$ and $M(T)_{FC}$, at 0.5 mT rise sharply below 70 K indicative of an onset of a magnetic transition. $M(T)_{ZFC}$ reaches maximum at 25 K followed by a rapid decrease suggesting antiferromagnetic (AF) interaction. In contrast, $M(T)_{FC}$ rises upon further cooling signifying a strong irreversibility in accord with sharp increase of a remanant magnetization below 30 K and hysteretic behavior of $M(H)$. The $M(H)$ at 2 K increases rapidly with field and approaches saturation above $\sim 0.5$ T. At 9 T $M(H)$ reaches 2.24 $\mu_B$ that is significantly higher than 1.30 $\mu_B$ expected for AF coupled Ni(II) $S = 1$ and [TCNE]$^-$ ($S = 1/2$) suggesting a ferromagnetic (FM) interaction. The unpaired Ni$^{II}$ spins and those on the [TCNE]$^-$ reside in orthogonal orbitals resulting in FM coupling. Assuming that similarly to Fe[TCNE][FeCl$_4$](MeCN)$_2$\textsubscript{1} consists of Ni$^{II}$ - $\mu_4$-[TCNE]$^-$ layers we believe that the decrease of $M(T)_{ZFC}$ below 25 K is due to AF coupling between the layers while the interaction within the layer is FM in contrast to the AF one reported for Fe, V, and Mn analogues.

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