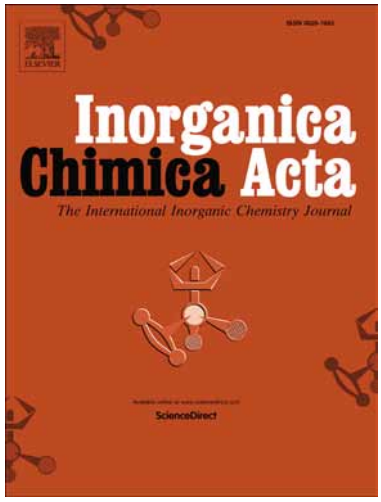

Research paper

Tetranuclear nickel cubane cluster formed by the hydrolysis of nickel koneramine complex

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Tetranuclear nickel cubane cluster formed by the hydrolysis of nickel koneramine complex

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Abstract:

Hydrolysis of a nickel(II) complex of a hemiaminal ether ligand yielded a tetranuclear $Ni_4(\mu_3\text{-}O)_4$ cubane cluster. The structural, electrochemical, thermal and physical properties of the cluster were studied and reported here.

Synthesis, structural, magnetic, electrochemical and photochemical studies of tetranuclear transition metal clusters are topical in the context of mimicking oxygen-evolving center of photosynthesis[1] and of the development of single molecular magnets.[2-10] Manganese clusters are of high importance owing to the fact that the photosynthetic splitting of water into oxygen is done by Mn_3CaO_4 cluster of the photosystem II (PSII) present in the plants and other organisms.[1,2,4,11] Other transition metal clusters such as Cu_4O_4,[5,9,10,12] Fe_4O_4,[13] Co_4O_4,[14] Co_4Cl_4,[15] heterometallic clusters such as Tb_2Ni_2,[16] Ni_4Cl_4[15] and Ni_4O_4 clusters[3,6-8,17-22] are reported in the past as single molecular magnets. Three tetranuclear Ni_4O_4 cubane molecules of the formula $[Ni(\mu_3\text{-}OCH_2Py)(ROH)Cl]_4$, where R is CH_3, CH_2CH_3 or $CH_2CH_2C(CH_3)_3$, have been reported as single molecular magnets in the year 2003 by Christou and Hendrickson.[3] The synthesis was done by the reaction of equimolar amounts of $NiCl_2{\cdot}6H_2O$ and pyridine-2-methanol in alcohol in the presence of sodium methoxide at refluxing conditions. Due to the interesting magnetic properties of the clusters, $[Ni(\mu_3\text{-}OCH_2Py)(ROH)Cl]_4$, three more Ni_4O_4 cubanes of the same family have been reported with fast magnetization tunneling properties.[6,7] In the year 2010, Braunstein reported the closely related tetraaqua-Ni_4O_4 cubane, $[Ni(\mu_3\text{-}OCH_2Py)(H_2O)Cl]_4{\cdot}THF{\cdot}H_2O$, isolated from a peculiar reaction where appropriate amount of a heptanuclear Ni_7 cluster $[Ni_7(OCH_2Py)_7]Cl_2{\cdot}CH_2Cl_2{\cdot}H_2O$ was mixed with $[NiCl_2(DME)]$.[8] pysub[23] hameury[24]