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Abnormal magnetic behaviors and large magnetocaloric effect in $MnPS_3$ nanoparticles

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A nanostructured honeycomb lattice consisting of $MnPS_3$ nanoparticles synthesized via the ion-exchange technique was found to have restacked molecular layers stabilized by H_2O insertion between the layers. Susceptibility (χ) and heat capacity measurements showed the absence of long range magnetic ordering, at least down to 2 K. However, the χ data showed that the system possesses a high effective Curie temperature, suggesting that the system is in a high spin lattice disordered state. Evaluation of the magnetocaloric effect indicates that the system has a large reversible magnetic-entropy change ($-\Delta S_m$) of 6.8 and 12.8 J/kg K and an adiabatic temperature change (ΔT_{ad}) of 3.8 K and 8 K at 2.85 K for magnetic field changes of 3 T and 9 T, respectively. © *2012 American Institute of Physics*. [doi:10.1063/1.3679409]

MPX_3 (M = Mn, Fe, Co, Ni, etc. transition metals; X = S, Se) compounds have attracted much attention[1–13] to this family due to their layered structure combined with high anisotropy; their special, but still uncertain and interesting, magnetic orderings[1,2]; and their potential applications as cathode material for secondary batteries,[3] ion-exchange applications,[4] ferroelectric materials,[5] and non-linear optically active materials,[6,7] as well as their very interesting potential to yield molecular magnets via the intercalation of exotic polymer

exfoliated the layered compounds $MnPS_3$ and $CdPS_3$ to form single molecular layers in suspension in water using the same ion exchange method.[14] Our XRD results are the same as in their reports, indicating that our nanoparticles are restacked single molecular layers separated by crystallised H_2O. The H_2O separates the individual molecular layers and stabilizes the restacked structure. The XRD data also show a nearly pure single phase, as there is not an obvious impurity peak in Fig. 1(a). The morphology of the $MnPS_3$ nanoparticles was