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Evidence for Multicritical Behavior in Nanostructured Mn-intercalated TaS_2[1] PAUL SHAND, COREY COOLING, ZACHARY GRIFFITH, TIMOTHY KIDD, LAURA STRAUSS, University of Northern Iowa — Nanostructured Mn-intercalated TaS_2 was prepared with a nominal Mn concentration of 25%. The sample consisted of nanotube structures with diameters between 30 nm and 300 nm. X-ray diffraction measurements indicated that the Mn was incorporated into intercalation sites between the TaS_2 layers. The sample exhibited Curie-Weiss behavior virtually all the way down to the Curie-Weiss temperature of 91 K, demonstrating the absence of significant chemical clustering and short-range order in the paramagnetic regime. Magnetization versus temperature measurements indicated a ferromagnetic transition at ∼90 K, which is somewhat higher than that for bulk crystalline $Mn_{0.25}TaS_2$. An Arrott plot confirms the ferromagnetic transition at 87 K, with critical exponents close to mean-field values. However, ac susceptibility measurements in the presence of a dc bias field suggest the presence of another transition at 81 K, with critical exponents much larger than mean-field values. A scaling plot using these unusual exponents exhibited excellent collapse of the data. We interpret this behavior in terms of a nearby multicritical point, with the system exhibiting re-entrant cluster-glass behavior.

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