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**TEMPERATURE AND THE FIELD DEPENDENCE OF THE MAGNETIZATION  
CLOSE TO ORDER-DISORDER PHASE TRANSITIONS  
IN DMMn AND THE CHROMIUM-DOPED DMMn**

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## ABSTRACT

We study the temperature and field dependence of the magnetization  $M(T,H)$  for the order-disorder transition in DMMn and the chromium-doped DMMn close to  $T_C$ . By analyzing the experimental data for  $M(T,H)$  from the literature according to the power-law formula, values of the critical exponent ( $\beta$ ) and the critical isotherm ( $\delta$ ) are deduced and also, the temperature dependence of magnetization  $M(T)$  is calculated from the molecular field theory for those compounds.

Our calculated  $M(T)$  and the values of  $\beta$  and  $\delta$  from the analysis of  $M(T,H)$  indicate that DMMn and chromium-doped DMMn undergo nearly second order transition.

**KEY WORDS:** Magnetization. Order-disorder transition. DMMn, DMMn-Cr1, Cr2, Cr3.

## 1. INTRODUCTION

Metal organic frameworks (MOFs) have been studied extensively since they show coexistence of electric and magnetic order at the same phase below the transition temperature [1-6]. They are metal formates templated by organic compounds with the general formula (cat)  $M(\text{HCOO})_3$ ,  $M=\text{Mg, Zn, Mn, Ni, Co, Fe}$  and cat=ammonium [4, 7], methyammonium [8], dimethyl ammonium (DMA) [1-3, 5, 6, 8], as also pointed out previously [9].

MOFs of formula  $(\text{CH}_3)_2\text{NH}_2\text{M}(\text{HCOO})_3$ ,  $M=\text{Mn, Zn, Ni, Co, Fe}$  exhibit electric ordering at 160-185K, associated with ordering of the  $\text{DMA}^+$  cations [1-3, 5, 6, 10-12] and they also show magnetic ordering at 8-36K [2, 6, 10, 11]. Among those compounds, DMMn has been extensively studied since it exhibits multiferroic properties, it crystallizes in the perovskite

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