

Comment on the paper "Nature of Low-Temperature Phase Transitions in $\text{CaMn}_7\text{O}_{12}$ "

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Resubmitted

We insist on saying that the anomalies observed in magnetization, specific heat and thermal expansion of $\text{CaMn}_7\text{O}_{12}$ at $T_S = 89$ K and $T_M = 49$ K reported in O. Volkova et al., Pis'ma v ZhETF **82**, 498 (2005) [JETP Lett. **82**, 444 (2005)] and mentioned in Pis'ma v ZhETF **82** 724 (2005) [JETP Lett. **82**, 642 (2005)] are both of magnetic origin.

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Recent papers by Vol'kova et al. [1, 2] describe the nature of low-temperature phase transitions in $\text{CaMn}_7\text{O}_{12}$. The authors [1] clearly show the existence of anomalies at $T_S=89$ K and $T_M=49$ K in $\text{CaMn}_7\text{O}_{12}$ by using three complementary techniques: magnetization, specific heat and thermal expansion measurements. The conclusion given in [1] is that the transitions at $T_M=49$ K and $T_S=89$ K are of magnetic and structural origin, respectively. These conclusions are based on the differences of $\text{CaMn}_7\text{O}_{12}$ magnetization $M(T)$ measured with field cooling (FC) and zero field cooling (ZFC). A behavior characteristic for spin-glass with differences between ZFC and FC magnetization measurements was observed below $T_M=49$ K [1]. At $T>49$ K there was no difference between FC and ZFC magnetization measurements, there was a kink on the $M(T)$ curve at $T_S=89$ K and a Curie-Weiss behaviour above 89 K [1]. We do not agree with the conclusion of the authors of [1] that the transition at $T_S = 89$ K in $\text{CaMn}_7\text{O}_{12}$ is not of magnetic origin.

The microstructure may influence the physical properties of $\text{CaCu}_x\text{Mn}_{7-x}\text{O}_{12}$ [3–5] compounds. It would be helpful if the authors of [1] could give more details about the microstructure of the $\text{CaMn}_7\text{O}_{12}$ sample used and about possible impurity phases. This is especially important for the Mn_3O_4 impurity phase which becomes ferrimagnetically ordered at 45 K [6], i.e. near $T_M=49$ K.

Secondly, we would like to emphasize some of our earlier $\text{CaMn}_7\text{O}_{12}$ neutron scattering [7, 8] and synchrotron radiation (SR) [9] results:

- The appearance of new Bragg peaks in the $\text{CaMn}_7\text{O}_{12}$ neutron diffraction patterns at 89 K is associated with a decrease of the background level [7] characteristic for a transition between a paramagnetic state (above 89 K) and a magnetic long range ordered state (below 89 K).
- The Bragg peaks observed in small angle neutron scattering (SANS) $\text{CaMn}_7\text{O}_{12}$ studies correspond-

ing to an interspacial distance of $d=52$ Å disappear at 89 K [8].

- There is no change of the intensity, position, nor width of the nuclear (structural) Bragg peaks observed in the $\text{CaMn}_7\text{O}_{12}$ neutron diffraction patterns [7] and high resolution SR diffraction patterns [9] below and above 89 K [7].

In conclusion, we insist on saying that we do not see any structural changes of $\text{CaMn}_7\text{O}_{12}$ at $T_S=89$ K and that this phase transition is of magnetic origin. Our neutron diffraction data [7, 8] and magnetization measurements by Vol'kova et al. [1] can be explained together by assuming a long-range magnetically ordered state between 89 K and 49 K which do not show spin-glass type behavior.

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