Magnetovolume and Baromagnetic effects in antiperovskite $Mn_3XN(C)$ compounds

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There exist abundant physical properties, such as superconductivity, giant magnetoresistance, negative/zero thermal expansion (NTE/ZTE), near zero temperature coefficient of resistivity, magnetostriction, piezomagnetism, magnetocaloric, ferromagnetic shape memory effect (FSM), barocaloric and baromagnetic effects, etc. in antiperovskite $Mn_3XN(C$) compounds,. Herein we show a series of NTE/ZTE behaviors in Mn_3XN compounds, which can be tunable and modified over a wide temperature range by elemental doping, substitution or introduction of vacancies in antiperovskite Mn_3XN compounds. The origin of abnormal thermal expansion properties in Mn_3XN compounds is discussed based on the strong "spin-lattice" coupling supported by the neutron diffraction results.

Baromagnetic effect is also investigated in antiperovskite structured Mn_3XN compounds. The baromagnetic effect at different pressures and temperatures are studied in $Mn_3Ga_{0.95}N_{0.94}$, which is represented by the parameter (Δm_p), i.e. the difference between the data at different pressures with the solidifying temperature:

$$\Delta m_p = m(T,p) - m(T,p_{ap})$$

The maximum of the baromagnetic effect under 600 MPa is 2.28 μ_B. This is the first time to report about baromagnetic effect in antiperovskite compounds.

Keywords: antiperovskite, negative/zero thermal expansion, baromagnetic, lattice-spin coupling

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