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Optimized Magnetocaloric Materials[1]

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The discovery of the giant magnetocaloric effect in $Gd_5Si_2Ge_2$ and other R_5T_4 compounds (R = rare earth metal and T is a Group 14 element) generated a broad interest in the magnetocaloric effect and magnetostructural transitions. Reports on the giant magnetocaloric effect in other systems soon followed. These include $MnFeP_xAs_{1-x}$ and related compounds, $La(Fe_{1-x}Si_x)_{13}$ and their hydrides, $Mn(As_xSb_{1-x})$, $CoMnSi_xGe_{1-x}$ and related compounds, Ni_2MnGa and some closely related Heusler phases, and a few other systems. A common feature is the enhancement of the magnetic entropy effect by the overlapping contribution from the lattice, regardless whether it is a massive structural change like in R_5T_4 compounds, or only a phase volume change as in $La(Fe_{1-x}Si_x)_{13}$. Both the magnetic and lattice entropies are, therefore, important and each contribution must be maximized in order to have the optimum magnetocaloric effect. Both of these entropy terms and the potential pathways towards a further enhancement of the giant magnetocaloric effect will be discussed.

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