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Ferromagnetism and large magnetocaloric effect in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$ clathrates M.H. PHAN, A. CHATURVEDI, S. STEFANOSKI, H. KIRBY, G.S. NOLAS, H. SRIKANTH, University of South Florida, V. FRANCO, Universidad de Sevilla — Semiconductors with the clathrate hydrate crystal structure are widely known for their excellent thermoelectric properties. The presence of Eu with large magnetic moment ($7.94 \mu_B$) also makes them very interesting for magnetic and magnetocaloric studies. We report large magnetocaloric effect (MCE) in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$ type-VIII clathrates and on the influence of Sr doping on the magnetic properties and MCE in $\text{Eu}_8\text{Sr}_{8-x}\text{Ga}_{16}\text{Ge}_{30}$ ($x = 0, 4$) type-I clathrates. Experimental results reveal a correlation between the long-range ferromagnetism and giant MCE in $\text{Eu}_8\text{Ga}_{16}\text{Ge}_{30}$ type-VIII clathrates. The substitution of Sr for Eu increases the Eu-Eu distance which consequently decreases the Curie temperature (T_C), saturation magnetization, and MCE in $\text{Eu}_8\text{Sr}_{8-x}\text{Ga}_{16}\text{Ge}_{30}$ ($x = 0, 4$) type-I clathrates. In addition to the paramagnetic-ferromagnetic transition at T_C , a new low temperature magnetic transition is observed in MCE experiments. This transition is likely associated with the ordering of the magnetic moments of Eu. The excellent magnetocaloric properties of the clathrate materials make them very interesting for cryogenic magnetic refrigeration applications.

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