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Superconductivity of Ba8Si46-xGax clathrates[1] YANG LI, Department of General Engineering, University of Puerto Rico at Mayaguez, PR 00681, USA, RUIHONG ZHANG, NING CHEN, XINGQIAO MA, GUOHUI CAO, Department of Physics, University of Science and Technology Beijing, 100083, China, Z.P. LUO, C.R. HU, JOSEPH H. ROSS, JR., Department of Physics, Texas A&M University, College Station, TX 77843 — We have presented a combined experimental and theoretical study of the effect of Gallium substitution on the superconductivity of the type I clathrate Ba8Si46-xGax. In Ga-doped clathrates, the Ga state is found to be strongly hybridized with the cage conduction-band state. Ga substitution results in a shift toward to a lower energy, a decrease of density of states at Fermi level, a lowering of the carrier concentration and a breakage of integrity of the sp3 hybridized networks. These play key roles in the suppression of superconductivity. For Ba8Si40Ga6, the onset of the superconducting transition occurs at Tc=3.3 K. The investigation of the magnetic superconducting state shows that Ba8Si40Ga6 is a type II superconductor. The critical magnetic fields were measured to be Hc1=35 Oe and Hc2=8.5 kOe. Our estimate of the lectron-phonon coupling reveals that Ba8Si40Ga6 is a moderate phonon-mediated BCS superconductor.

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