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Magnetic field penetration depth of superconducting aluminum-substituted $Ba_8Si_{42}Al_4$ clathrate[1] YANG LI, JOSE GARCIA, GIOGIOVANNI FRANCO, Univ of Puerto Rico - Mayaguez — During past years, efforts have been made to explore the superconductivity of Group IV clathrates with particular attention to the sp3 hybridized networks. In the study, we report on the superconductivity of Al-substituted type-I silicon clathrates. Pure phase samples of the general formula Ba8Si46-xAlx with different values of x were synthesized. The magnetic susceptibility measurements show that Ba8Si42Al4 is a bulk superconductor, with an onset at Tc=6 K. Al substitution results in a large decrease of the electronic density of states at the Fermi level, which explains the decreased superconducting critical temperature within the BCS framework. To further characterize the superconducting state, we carried out magnetic measurements showing Ba8Si42Al4 to be a type II superconductor. The critical magnetic fields were measured to be Hc1 = 77 Oe and Hc2 = 40 kOe. We deduce the London penetration depth 2900 Å and the coherence length 90 Å. Our estimate of the electron–phonon coupling reveals that Ba8Si42Al4 is a moderate phonon-mediated BCS superconductor.

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