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Superconductivity in Opal-based superconducting nanocomposites M.K. LEE, MOST Instrument Center At NCKU, Tainan 70101, Taiwan, E.V CHARNAYA, Institute of Physics, St. Petersburg State University, St. Petersburg, Petrodvorets 198504 Russia, L.J. CHANG, Department of Physics, National Cheng Kung University, Tainan 70101, Taiwan, YU. A. KUMZEROV, A. F. Ioffe Physico-Technical Institute RAS, St. Petersburg 194021, Russia, M.F. LIN, Department of Physics, National Cheng Kung University, Tainan 70101, Taiwan — In this study, we investigate superconducting nanocomposites (SCNCs) to elucidate superconductivity in nanostructured type I superconductor. In, Sn and Hg are loaded into opal matrices by high pressure up to 10kbar, in which introducing superconducting metals into templates preserves their own 3D nanostructures. The opal matrices is adopted because it is a well-developed nanoconfinement and widely used in the studies of photonic crystal due to its periodically-superlatticed nanoporous structure. The SCNCs are then measured by Quantum Design MPMS 3 under different external magnetic fields reveal the field dependences of Tc and irreversibility temperature (Tirr). Next, AC susceptibility measurements of SCNCs determine grain coupling, vortex dynamics and field dependence of activation barrier (Ua) as well as Tc. Additionally, the phase diagrams of these SCNCs are analyzed to study superconductivity for a system with similar nanogeometry. Exotic phase diagrams in the opal SCNC studies reveal an enhanced upper critical field (Hc2 (0)) and curvature crossover of upper critical field line. Additionally, according to the field dependence of Ua(H), curvature crossover of the upper critical field line can occur, owing to vortex phase transition.

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