Detailed analysis of magnetization loops of electrospun non-woven superconducting fabrics

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Networks of superconducting $Bi_2Sr_2CaCu_2O_8$ (Bi-2212) nanowires were fabricated by the electrospinning technique. The nanowires have a diameter of the order of 150-200 nm and lengths up to the micrometer range and form a non-woven, fabric-like network with numerous interconnects enabling a current flow between the nanowires. The porosity of this nanowire network is 0.9928. Therefore, this material represents a novel class of ultraporous high-temperature superconductors. The magnetization of the nanowire networks [*M(T)* and *M(H)*] were recorded by SQUID magnetometry. The magnetic properties were analyzed using the extended critical state model (ECSM). It is supposed that the averaged diameter of the nanowires rules the magnetic field dependence of the critical current density of the nanowire network. Single nanowires have remarkably high values of the critical current density of 1.69×10^7 A/cm^2 at 5 K. The resulting sample critical current density of 7.44×10^4 A/cm$_2$ at 5 K is fine for this lightweight material. Using the ECSM, several important magnetic parameters could be determined including the penetration field, H_p, the irreversibility fields, H_{irr}, the upper critical field, H_{c2}, and the flux pinning forces. Applications for this material class may be found in the direction of sensors, thin shielding layers or nanoporous bulks.