

Low temperature magnetoresistance measurements on bismuth nanowire arrays

Kaiser C, Weiss G, Cornelius TW, Toimil-Molares ME, Neumann R
Journal of Phys.: Condens. Matter 21 (2009) 205301

We present low temperature resistance $R(T)$ and magnetoresistance measurements of Bi nanowires with diameters between 100 and 500nm, which are close to single-crystalline. The nanowires were fabricated by electrochemical deposition in pores of polycarbonate membranes. $R(T)$ varies as T^2 in the low temperature range $1.5\text{K} < T < 10\text{K}$ and exhibits a maximum which shifts from 140 K to 250 K with decreasing wire diameter. An unexpected effect is observed in $R(T)$ when a magnetic field is present. It can be related to the temperature dependence of the magnetoresistance. The transverse magnetoresistance of all samples shows a clear $B^{1.5}$ variation. Its size depends strongly on the diameter of the wires but only weakly on temperature. Finally, a steplike increase in the magnetoresistance of our sample with a wire diameter of 100 nm was found and might be attributed to a transition from one- to three-dimensional localization.