

Burnout current density of bismuth nanowires

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Single bismuth nanowires with diameters ranging from 100 nm to 1 μm were electrochemically deposited in ion track-etched single-pore polycarbonate membranes. The maximum current density the wires are able to carry was investigated by ramping up the current until failure occurred. It increases by three to four orders of magnitude for nanowires embedded in the template compared to bulk bismuth and rises with diminishing diameter. Simulations show that the wires are heated up electrically to the melting temperature. Since the surface-to-volume ratio rises with diminishing diameter, thinner wires dissipate the heat more efficiently to the surrounding polymer matrix and, thus, can tolerate larger current densities.