Assessing the thermoelectric properties of single InSb nanowires: the role of thermal contact resistance

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The peculiar shape and dimensions of nanowires (NWs) have opened the way to their exploitation in thermoelectric applications. In general, the parameters entering into the thermoelectric fi gure of merit are strongly interdependent, which makes it dif fi cult to realize an optimal thermoelectric material. In NWs, instead, the power factor can be increased and the thermal conductivity reduced, thus boosting the thermoelectric ef fi ciency compared to bulk materials. However, the assessment of all the thermoelectric properties of a NW is experimentally very challenging. Here, we focus on InSb NWs, which have proved to be promising thermoelectric materials. The fi gure of merit is accurately determined by using a novel method based on a combination of Raman spectroscopy and electrical measurements. Remarkably, this type of experiment provides a powerful approach allowing us to neglect the role played by thermal contact resistance. Furthermore, we compare the thermal conductivity determined by this novel method to the one determined on the same sample by the thermal bridge method. In this latter approach, the thermal contact resistance is a non-negligible parameter, especially in NWs with large diameters. We provide experimental evidence of the crucial role played by thermal contact resistance in the assessment of the thermal properties of nanostructures, using two different measurement methods of the thermal conductivity.
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