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Heat Conduction in Graphene Flakes of Arbitrary Geometry[1]

SAMIA SUBRINA, DMITRI KOTCHETKOV, ALEXANDER BALANDIN, Nano-Device Laboratory, Department of Electrical Engineering, University of California - Riverside, Riverside, CA 92521, U.S.A. — It was reported that the values of the room temperature thermal conductivity of graphene exceed those of carbon nanotubes [1-2]. The measurements of the thermal conductivity of graphene utilized a technique where the excitation laser initiated a heat wave. The data extraction procedure assumed plane heat waves. Realistic graphene flakes have variations in their width, and the heat wave front may deviate from the plane wave depending on the geometry of the flake. We report a numerical study of heat propagation in graphene flakes of arbitrary geometry. The thermal conduction was simulated using the finite element method. It was found that both the shape of the flake and the temperature distribution in the hot spot affect the extracted values. At the same time, for the flakes with the relatively constant width and the hot spot of the size comparable to the flake width, the thermal conductivity obtained within the simple plane-wave approximation give close values to our simulations. [1] A.A. Balandin, et al., Nano Letters, 8, 902 (2008) [2] S. Ghosh, et al., Appl. Phys. Lett., 92, 151911 (2008).

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