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A computational study of electrical transport in graphene-based films and composites JEREMY HICKS, ASHKAN BEHNAM, ANT URAL, Electrical and Computer Engineering, University of Florida — We study the electrical behavior of films and composites composed of a mesh of graphene sheets using Monte Carlo simulations. We take into account the sheet-sheet junctions with different areas as well individual graphene sheets in calculating the film/composite transport properties. We find that the resistivity of composites varies by many more orders of magnitude than films approaching the percolation threshold due to tunneling-percolation through the sheet network, but otherwise the two exhibit many of the same scaling trends. Furthermore, we find that resistivity in both cases is a strong function of graphene sheet aspect ratio, density, volume fraction, and device dimensions. We extract important parameters such as the critical exponents near the percolation threshold and compare them with the available experimental data. These results, explained through physical and geometrical arguments, give valuable insights into the factors influencing the electrical transport in graphene sheet films and nanocomposites. Such graphene-based nanomaterials might find applications in many fields such as photovoltaics, sensors, and multifunctional nanocomposites.

Ant Ural
Electrical and Computer Engineering, University of Florida

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