Institute of Paper Science and Technology
Atlanta, Georgia

IPST Technical Paper Series Number 850

Universal Material Property in Conductivity of Planar Random Microstructures

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May 2000

Submitted to
Physical Review B

Universal material property in conductivity of planar random microstructures

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Abstract

We study scatter involved in finite size scaling of the conductivity and resistivity tensors resulting, respectively, from uniform essential and natural boundary conditions applied to domains that are finite relative to the size of a heterogeneity. For various types of planar microstructures generated from Poisson processes (multi-phase Voronoi mosaics, composites with circular or needle-like inclusions, etc.) we report a universal property: the coefficient of variation of the second invariant stays practically constant at about 0.55 ± 0.1, irrespective of: the domain size, the boundary conditions applied to it, the contrast, and the volume fraction of either phase.

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