Abstracts

Effects of particle shape on the effective permittivity of composite materials with measurements for lattices of cubes

K.W. Whites and Feng Wu. "Effects of particle shape on the effective permittivity of composite materials with measurements for lattices of cubes." 2002 Transactions on Microwave Theory and Techniques 50.7 (Jul. 2002 [T-MTT]): 1723-1729.

The effects of inclusion shape on the quasi-static effective permittivity of a two-phase periodic composite material are discussed in this paper. The lattice is formed from complex-shaped conducting inclusions suspended in a host medium. The effective permittivity is computed using an accurate moment-method-based technique. Numerical results are presented for a variety of particle shapes including circular, square, and "rounded square" cylinders (two dimensional) as well as lattices of spheres and cubes (three dimensional). It was found that among these shapes, lattices of square cylinders and cubes produced nearly the minimal polarization per unit volume possible (a/spl grave/ la Maxwell/Maxwell Garnett). It appears that the strong mutual interaction between edges and corners of these particles is responsible for this effect. That is, it was observed that the mutual interaction between square cylinders and cubes caused a decrease in their dipole moments and, hence, the effective permittivity, which is opposite to the usual expectation from mutual interaction between circular cylinders and spheres. Experimental verification of this effect is provided by quasi-static conductivity measurements.

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