EFFECTIVE PERMITTIVITY OF DISPERSE SYSTEM WITH METALLIC INCLUSIONS

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The calculation of frequency-dependent effective dielectric function of the composite is old, but still unsolved problem [1–2]. There are many different approaches to approximate its solution [3–5], but there is no theory which would provide a complete quantitative agreement with the corresponding experimental data. This article discusses the matrix dispersion system with metal spherical inclusions randomly distributed in a dielectric matrix. Effective dielectric function of the system at low concentrations of particles is represented by the formula Maxwell-Garnett (MG) [2]. At certain concentrations there is a significant deviation of the results from the approximation MG due to the interaction between the inclusions.

Objective studies – synthesis method described in [6] for the case of a composite containing spherical metallic inclusions in two different sizes. Accounted for only a pair of multipole interactions between inclusions.

We used the mechanisms and patterns of absorption and scattering of electromagnetic radiation by individual metal spherical particles with the multipole interaction between them.

The calculations showed that the spectral dependence of the composite obtained by averaging all the possible positions of pairs of particles in the matrix. It is shown that with increasing volume fraction of particles in the multipole effects become significant interaction between the particles. Taking into account the dipole-dipole interaction between the particles of two kinds, the behavior of the

frequency dependence of the imaginary part of the effective dielectric constant of the system. In this approach possible generalization to the case of higher multipole pair interactions [7], as well as in case of many-particle interactions. This leads to partial smoothing of the frequency dependence of the imaginary part of effective permittivity. The same result may also lead to other factors – many-particle interactions, particle clustering, etc.