Saturation effects in silver-particle aggregates due to nonlinearity

A. BUIN, P. DECHATEL, H. NAKOTTE, New Mexico State University, V. DRACHEV, V. SHALAEV, School of Electrical and Computer Engineering, Purdue University — We present results for the extinction and absorption spectra of fractal aggregates consisting of silver particles, calculated in the quasistatic dipole approximation. We have solved the coupled-dipole equations iteratively, taking into account the nonlinear susceptibility $\kappa_{a3}(\text{Kerr})$, which is introduced in terms of an intensity-dependent dielectric function. To achieve self consistency, we used a modified version of Broyden’s mixing method. Nonlinearity is seen to suppress the giant enhancement effects found for linear polarizability. At intermediate intensities, we observe a tendency toward saturation and some hysteretic behaviour which is reminiscent of ferro-electrics. For fractal aggregates of particle radii in the 3-5 nm range, the behaviour is determined by saturation and no hysteretic effects are observed.


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Date submitted: 02 Dec 2004

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