

Single scattering vs multiple scattering theory: the conditions

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In this paper, we revisit the theory of single scattering and check for conditions leading to deviation of this theory from the multiple scattering light scattering theories, both theoretically and computationally. The well known structure factor is calculated for two types of aggregation clusters viz. Diffusion limited aggregation (DLA) and Diffusion limited cluster aggregation (DLCA). We make use of the TMATRIX code to find out scattered intensities off these clusters and to account for the multiple scattering effects in an aggregate. We emphasize the fact that single scattering theory is in reasonable good agreement with the multiple scattering theory for aggregation cluster of fractal dimension $D_f < 2$ (DLCA) and deviates largely for $D_f > 2$ (DLA) and in multipolar regime. For the strong multiple-scattering process, the structure factor deviates essentially from the single-scattering case. We have shown the comparison between the two theories for various optical parameters. Such studies have not been investigated with depth in the literature. Hence, our results provide an important insight towards the problem of light scattering.