Absorption Distribution of Thermal Radiation Inside a Micro Droplet Under Asymmetrical Infrared Illumination

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The prediction of light scattering and absorption of micro droplets under illumination by sunlight, flame, and others can help research in many fields, such as the evaporation of raindrops, forest fire prevention, and so on. The interaction of particles with thermal radiation has become the focus of research in related fields. The work of predicting the radiative properties of large droplets has been developed by applying geometrical optics. There are few works about micro droplets under infrared illumination. The Maxwell equations need to be solved for getting the absorption distribution of thermal radiation. For some applications, the internal inhomogeneous distribution of radiative energy absorption can be of critical importance because of translucency. In this work, the finite-difference time-domain method (FDTD) is utilized to study the local absorption distribution in asymmetrically illuminated micro scaled droplets. The internal dimensionless absorption distribution function is defined to study the absorption distribution inside the particles. The parameters vary from 1 to 10, and the complex refractive index varies with wavelength. When the particle size parameter is small, the local radiation absorption distribution tends to be uniform. With an increase of the size parameter, there is an absorption peak inside the droplet. The position of the maximum absorption peak moves, and the value of the maximum absorption peak changes significantly with various size parameters of the particles. There are obvious interference fringes emerging inside the particles. And the shape of the absorption distribution inside the particle differs with complex refractive index.