

The Deposition of Submicron Fluorescent Aerosol Particles by a Closed-Loop Flow System

ABSTRACT

An aerosol flow system has been constructed to mimic the delivery of particles to the air-liquid interface. A colloidal suspension of submicron fluorescent core-shell silica-based particles was sprayed by an ultrasonic nebulizer. The dynamics of the aerosol settling was investigated by numerical simulation to determine the carrier gas flow rate, which was further verified through experimentation. Fluorescent microscopy, a non-vacuum imaging technique, was used to observe the particles deposited on the substrate. It was found that the apparent (fluorescent) size distribution was shifted from $2.9 \pm 6.0 \mu\text{m}$ to $1.7 \pm 2.2 \mu\text{m}$, which is correlated to the shift in the aggregate size from $0.70 \mu\text{m}$ to $0.24 \mu\text{m}$ due to the changes in the colloidal suspension concentration. In addition, the uniformity of the particles dispersed on the substrate was not significantly affected by the suspension's concentration, as confirmed by the inter-particle distance analysis. It is therefore suggested that the method presented here may potentially be applied for the deposition and analysis of submicron particles on various types of substrate (i.e. air-liquid interface) without the need for vacuum imaging analysis (e.g. electron microscopy).