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On the continuity equation of aerosol particles in a standing wave field

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ABSTRACT

The acoustic coagulation process is based mainly on the orthokinetic interaction of aerosol particles vibrating with different amplitudes and phases. The presence of drift forces, gathering particles at loops pr nodes of the standing wave, may play auxiliary role by effecting a local growth of particle concentration.

The standing wave produces regions of increased concentration and an orthogonal progressive saw-tooth waves causes proper agglomeration by maximizing the orthokinetic process.

In the presented paper we consider the continuity equation of aerosol particles in regions between nodes and antinodes and the problem of time variation of particle concentration under the influence of drift forces. We show that the concentration at points of stable equilibrium increases exponentially and we estimate the time constant of the process. The time constant depends strongly on the particle radius and frequency. Aerosols of particles of diameters less than several microns are the most dangerous for the environment and for man from almost all standpoints.

Considering different types of drift we pay special attention to those acting on relatively small particles. In the real sound field we have to deal with a non uniform field configuration, which means that the actual sound wave deviates from the perfect one dimensional wave. The present paper deals with main effects of two-dimensional sonic fields on particle-gas interactions.

In the case when the nodal and antinodal surfaces of the standing wave are convex, the particles move along some curves and, as we expect, gather in some particular points and not only in some planes.

This means that one can obtain much greater concentration of particles in some definite regions than in the case of plane standing wave.