Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 8, 6469-6481, 2008
www.atmos-chem-phys.net/8/6469/2008/

Internally mixed soot, sulfates, and organic matter in aerosol particles from Mexico City

K. Adachi[1,2] and P. R. Buseck[1,2]
[1]School of Earth and Space Exploration, Arizona State University, Tempe, Arizona, USA
[2]Department of Chemistry and Biochemistry, Arizona State University, Tempe, Arizona, USA

Abstract. Soot particles, which are aggregated carbonaceous spherules with graphitic structures, are major aerosol constituents that result from burning of fossil fuel, biofuel, and biomass. Their properties commonly change through reaction with other particles or gases, resulting in complex internal mixtures. Using a transmission electron microscope (TEM) for both imaging and chemical analysis, we measured ~8000 particles (25 samples) with aerodynamic diameters from 0.05 to 0.3 μm that were collected in March 2006 from aircraft over Mexico City (MC) and adjacent areas. Most particles are coated, consist of aggregates, or both. For example, almost all analyzed particles contain S and 70% also contain K, suggesting coagulation and condensation of sulfates and particles derived from biomass and biofuel burning. In the MC plumes, over half of all particles contained soot coated by organic matter and sulfates. The median value of the soot volume fraction in such coated particles is about 15%. In contrast to the assumptions used in many climate models, the soot particles did not become compact even when coated. Moreover, about 80% by volume of the particles consisting of organic matter with sulfate also contained soot, indicating the important role of soot in the formation of secondary aerosol particles. Coatings on soot particles can amplify their light absorption, and coagulation with sulfates changes their hygroscopic properties, resulting in shorter lifetimes. Through changes in their optical and hygroscopic properties, internally mixed soot particles have a greater effect on the regional climate of MC than uncoated soot particles.

Final Revised Paper (PDF, 4691 KB) Discussion Paper (ACPD)

Citation: Adachi, K. and Buseck, P. R.: Internally mixed soot, sulfates, and organic matter in aerosol particles from Mexico City, Atmos. Chem. Phys., 8, 6469-6481, 2008. Bibtex EndNote Reference Manager