Physical and Chemical Properties of Anthropogenic Aerosols: An overview

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A wide variety of anthropogenic sources emit fine aerosols to the atmosphere. The physical and chemical properties of these aerosols are of interest due to their influence on climate, human health, and visibility. Aerosol chemical composition is complex. Combustion aerosols can comprise tens of thousands of organic compounds, refractory brown and black carbon, heavy metals, cations, anions, salts, and other inorganic phases. Aerosol organic matter normally contains semivolatile material that partitions between the gas-, liquid-, and particle-phases, a process controlled by dynamic equilibrium or interfacial mass transfer considerations. Volatile and semivolatile organic matter can undergo photo-oxidation in the atmosphere, creating particle nuclei or growing particles further via condensation. This diverse chemistry and processing of anthropogenic emissions aerosols produces distinct particle morphology and nanostructure that is heterogeneous, which in turn contributes to the optical properties, aerodynamic nature, and thus fate and transport of aerosols. Determination of the complex chemical nature of combustion aerosols requires utilizing a series of advanced analytical measurement techniques. *The focus of this discussion is on the measurements that have evolved in the aerosol and combustion science community for reliably measuring the physical and chemical properties of anthropogenic aerosols*. The use of both real-time and laboratory-based instrumentation will be examined. Topics will include monitoring with real-time particle instrumentation: (i) transient combustion events; (ii) single black carbon (BC) particles; (iii) the extent of volatile organic mass coatings, and (iv) measuring organic composition at low aerosol mass.