Carbonaceous Aerosol Processing in the Mexico City Metropolitan Area

Timothy B. Onasch, Aerodyne Research, Inc.; Jay G. Slowik, Boston College; Paul Davidovits, Boston College; Scott Herndon, Aerodyne Research, Inc.; Douglas R. Worsnop, Aerodyne Research, Inc.; Charles E. Kolb, Aerodyne Research, Inc.; Ezra Wood, Aerodyne Research, Inc.; W. Berk Knighton, Montana State University; Miguel Zavala, Massachusetts Institute of Technology; Dwight Thornhill, Virginia Polytechnic Institute and State University; Linsey Marr, Virginia Polytechnic Institute and State University; W. Patrick Arnott, Desert Research Institute; Claudio Mazzoleni, Los Alamos National Laboratory; Manvendra K. Dubey, Los Alamos National Laboratory; Rebecca J. Hopkins, Lawrence Berkeley National Laboratory; Mary K. Gilles, Lawrence Berkeley National Laboratory; Yury Desyaterik, Pacific Northwest National Laboratory; Alexander Laskin, Pacific Northwest National Laboratory

Timothy B. Onasch, Aerodyne Research, Inc., onasch@aerodyne.com

As part of the Mexico City Metropolitan Area (MCMA) component of the MILAGRO campaign (March 2006), polydisperse and mobility-selected particles were sampled by a time-of-flight Aerodyne aerosol mass spectrometer (ToF-AMS) and a scanning mobility particle sizer (SMPS). Sampling was performed from the Aerodyne mobile laboratory, which contained an array of particle, gas-phase, and meteorological instrumentation. Simultaneous measurements by the AMS and SMPS instruments yielded the particle mass, volume, density, composition, dynamic shape factor, and fractal dimension. Two types of ambient particles were observed: (1) fractal particles containing a refractory component assumed to be black carbon and (2) near-spherical particles characteristic of regional-scale transport. During the early morning, the ambient fractal particles were similar in morphology and composition to diesel-generated particles. However, as the morning progressed, the ambient fractal particles became larger and nearly spherical due to gas-to-particle condensation. The coatings on the fractal particles contained organic and inorganic compounds and are shown to be likely products of atmospheric photochemistry. The rate of photochemistry increased throughout the morning, as evidenced by ozone and particulate nitrate formation due to the increase in incident solar radiation. The fractal particles were no longer evident after late morning due to morphological changes implying that primary soot emissions in a polluted urban environment are processed rapidly via photochemically driven gas-to-particle condensation. Further analysis will include the results from the other particle and gas-phase instruments making simultaneous measurements.