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Chemical and Spatial Microscopy of Individual Organic Aerosols
ALEXEI V. TIVANSKI, Department of Chemistry, University of Iowa, REBECCA J. HOPKINS, MARY K. GILLES — Carbonaceous particles originating from biomass burning can account for a large fraction of organic aerosols in a local environment. Presently, their composition, physical, and chemical properties as well as their environmental effects are largely unknown. A distinct type of biomass burn particles, called "tar balls", have been observed in a number of field campaigns, both in fresh and aged smoke. They are characterized by their spherical morphology, high carbon content and ability to efficiently scatter and absorb light. Here, a combination of scanning transmission x-ray microscopy and near edge x-ray absorption fine structure spectroscopy is used to determine the shape, structure and size-dependent chemical composition of 150 individual tar ball particles ranging in size from 0.15 to 1.2 μm. Oxygen is present primarily as carboxylic carbonyls and oxygen-substituted alkyl functional groups. The observed chemical composition is distinctly different from black carbon and more closely resembles high molecular weight humic-like substances. A detailed examination of the carbonyl intensity as a function of particle size reveals the presence of a thin oxygenated interface layer on the tar balls, indicative of atmospheric processing of biomass burn particles.

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