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Mixing state of particles with secondary species by single particle aerosol mass spectrometer in an atmospheric pollution event

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Single particle aerosol mass spectrometer (SPAMS) was used to characterize size distribution, chemical composition, and mixing state of particles in an atmospheric pollution event during 20 Oct. – 5 Nov., 2015 in Xiamen, Southeast China. A total of 533,012 particle mass spectra were obtained and clustered into six groups, comprising of industry metal (4.5%), dust particles (2.6%), carbonaceous species (70.7%), K-Rich particles (20.7%), seasalt (0.6%) and other particles (0.9%). Carbonaceous species were further divided into EC (70.6%), OC (28.5%), and mixed ECOC (0.9%). There were 61.7%, 58.3%, 4.0%, and 14.6% of particles internally mixed with sulfate, nitrate, ammonium and C2H3O, respectively, indicating that these particles had undergone significant aging processing. Sulfate was preferentially mixed with carbonaceous particles, while nitrate tended to mix with metal-containing and dust particles. Compared to clear days, the fractions of EC-, metal- and dust particles remarkably increased, while the fraction of OC-containing particles decreased in pollution days. The mixing state of particles, excepted for OC-containing particles with secondary species was much stronger in pollution days than that in clear days, which revealed the significant influence of secondary particles in atmospheric pollution. The different activity of OC-containing particles might be related to their much smaller aerodynamic diameter. These results could improve our understanding of aerosol characteristics and could be helpful to further investigate the atmospheric process of particles.