SOME MEASUREMENTS OF THE MIXING STATE OF SOOT-CONTAINING PARTICLES AT URBAN AND NON-URBAN SITES

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Model simulations show that the radiative forcing is modified in the positive direction in internal mixture of soot and sulfate aerosols compared with external mixture, which causes the direct effects of aerosols to become weakened. However, analysis of the mixing state of soot-containing particles is presently insufficient. In this study, number fraction and size of soot-containing particles were investigated at urban and non-urban sites using the dialysis of water-soluble components and electron microscopy. Figure 1 shows examples of electron micrographs of particles before and after the water dialysis. The samples were collected with a low-pressure impactor and the particles of 0.08-1.6 µm diameter were examined.

At an urban site, Sapporo, Japan (43.72°N, 141.37°E), soot-containing particles were present in high number fractions (42-49%), whereas low number fractions (3-11%) were measured at non-urban sites of Fukue Island, Japan (32.73°N, 128.73°E), and Poker Flat, Alaska (65.12°N, 147.33°W). The mass fractions of elemental carbon (EC), obtained by filter sampling and thermal analysis, showed similar results. On the other hand, the number fractions of internally mixed soot particles in soot-containing particles were 19-72% at Fukue Island and 56% at Poker Flat, whereas only 5-7% were observed in Sapporo. This difference might be caused by residence time of aerosols: externally mixed soot particles would be recently emitted from combustion process, whereas internally mixed soot particles would have been transported there over long distances and become covered with water-soluble material. Internally mixed soot particles, with the modal size range of 0.17-0.36μm or 0.36-0.75μm, tended to be larger than externally mixed soot particles. The ratio of internally mixed soot particles in soot-containing particles increased with particle size.

Figure 1 Electron micrographs of particles collected at Fukue Island, Japan, before (a) and after (b) the water dialysis. Particles shown by arrows are internally mixed soot particles.

Reference