Single particle analysis by the combined use of quantitative ED-EPMA, Raman microspectrometry, and ATR-FT-IR imaging techniques

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ABSTRACT: In this work, the practical applicability of the combined use of low-Z particle electron probe X-ray microanalysis (EPMA), Raman microspectrometry (RMS), and attenuated total reflectance (ATR) FT-IR imaging techniques for the characterization of individual aerosol particles is demonstrated. These three single particle analytical techniques provide complementary information on the physicochemical characteristics of the same individual particles, that is, the low-Z particle EPMA for the information on the morphology and elemental concentration; Raman microspectrometry on the functional group, molecular species, and chemical mixing states; and ATR-FT-IR imaging on the functional group, molecular species, and crystal structure. Individual standard particles such as calcite, gypsum, anhydrite, calcium nitrate, sodium sulfate, sodium nitrate, quartz, and microcline and atmospheric aerosol sample collected in Incheon, Korea were investigated to demonstrate the practical feasibility of the combined application of three techniques for the characterization of individual particles. The physical and chemical properties of individual particles could be characterized more clearly, and this analytical approach will be useful to get specific information on the characteristics of airborne aerosol particles such as molecular composition, heterogeneity, and atmospheric reactivity.

Keyword: *single particle analysis, low-Z particle EPMA, Raman microspectrometry, ATR-FT-IR imaging*