X-ray analysis of MSWI fly ash using multiple approaches

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Quantities of municipal solid waste incineration (MSWI) fly ashes generated from waste incineration plant are increasing every year. MSWI fly ash is typically analyzed using several methods for material development such as cement, ceramic, stone, and zeolite. In other words, materials recycling from MSWI fly ash depends onto components of raw materials. Quantitative analysis of major and minor elements in MSWI fly ash is essential for establishing safe and effective recycling processes. The characteristics of fly ash are traditionally evaluated from the overall elemental abundance determined by an atomic absorption spectrometry (AAS), an inductively coupled plasma atomic emission spectrometry (ICP-AES), an inductively coupled plasma mass spectrometry (ICP-MS), and a X-ray fluorescence (XRF) spectrometry. XRF spectrometry is a rapid and convenient method for nondestructive multi-elemental analysis, and its measurement range is from parts-per-million fractions to major components. MSWI fly ash contains unburn component which is not subject to analyze by XRF spectrometry. Generally, unburn component is analyzed as ignition loss on heating process. The scattering FP method[1] can estimate unmeasured components and component of MSWI fly ash is evaluated with more accurately. In addition, characteristics including crystalline phases in MSWI fly ash such as shown in Fig. 1 are related to leaching properties of heavy metals[2]. Crystalline phases are analyzed by X-ray diffraction and minor heavy elements are quantified by total reflection X-ray fluorescence (TXRF) spectrometry with internal standard method. Their methods are used as non-destructive analyses as with XRF. In this research, components in MSWI fly ash were evaluated by three X-ray analyses as multiple approaches. In presentation, results of leaching properties combined with XRD and TXRF, and component by XRF are discussed.

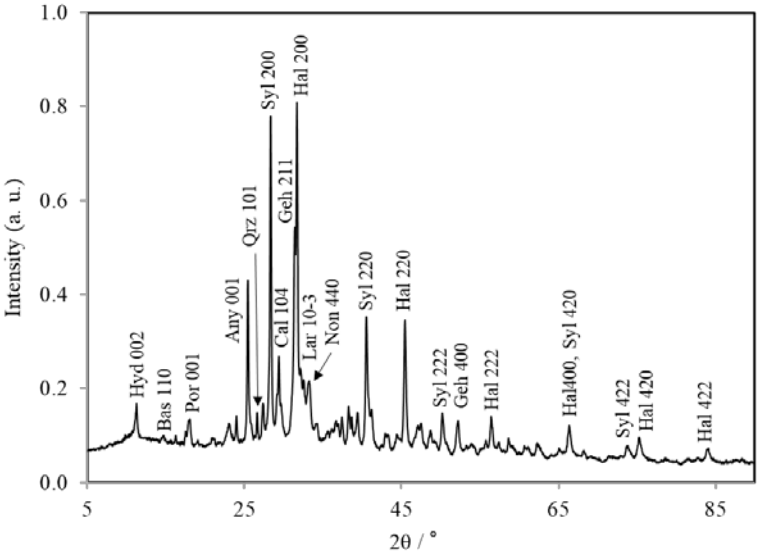

Fig. 1 Identification of crystalline phases in MSWI fly ash.
Any: Anhydrite ($CaSO_4$), Bas: Bassanite ($CaSO4(H_2O)_{0.5}$), Cal: Calcite ($CaCO_3$), Geh: Gehlenite ($Ca_2Al_2SiO_7$), Hal: Halite (NaCl), Hyd; Hydrocalumite ($Ca_2Al(OH)_6Cl(H_2O)_2$), Lar: Larnite ($Ca_2(SiO_4)$), Non: Nonacalcium cyclo-hexaaluminate ($Ca_9(Al_2O_6)_3$), Qrz: Quartz (α-SiO_2), Por: Porlandite ($Ca(OH)_2$), Syl: Sylvite (KCl)

References

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