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Metallic elements occurrences within metallic fragments in the municipal waste incineration bottom ash

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Bottom ash (BA) from municipal solid waste incineration (MSWI) is composed of grainy ash material, residual components and metallic fragments (from few μm up to 3-5 cm). Its mineral and chemical composition is related to the composition of the waste stream in the incinerator operational area. Wide use of thermal techniques in management of solid waste makes important the studies on valuable components and their distribution within the material in terms of their further processing. By using various valorization or extraction techniques it is possible to extend the range of its possible further application.

To investigate metallic elements distribution within metallic fragments of the MSWI BA material produced in municipal waste incineration plant in Poland were collected in 2015 and 2016. BA and its components were investigated using spectroscopic methods of chemical analysis: ICP-OES, ICP-MS, LECO and EDS (used for microanalysis during SEM observations).

BA is a material rich in Si (22.5 wt%), Ca (13.4 wt%), Fe (4 wt%), Al (5.2 wt%) and Na (3.5 wt%), composed of equal part of amorphous (silicate glass dominated) and crystalline phase (rich in silicates, aluminosilicates, oxides of non- and metallic elements and sulphates). The content of metallic elements (Al, Fe, Mg, Ti, Mn, Cr, Ni, Sc, Mo, Cu, Pb, Zn, Sn) is 11.5 wt% with domination of Al (5.2 wt%) and Fe (4 wt%) and elevated values of Mg (1 wt%), Ti (0.54 wt%), Cu (0.26 wt%) and Zn (0.27 wt%) (Kowalski et al., 2016). They were mostly concentrated in the form of metallic fragments, mainly as metallic inclusions in the size of 1-20 μm and separated metallic grains in the size of 50-300 μm.

Metallic fragments present in the BA are characterized by their composition heterogeneity and various oxygen content. Fragments are rarely composed of single metallic element and usually in their composition up to few main elements dominated over others. The most common were Fe-, Al- and Zn-rich fragments forming respectively 70%, 15% and 5% of the total amount of fragments. Fe occurred mainly as component of metallic inclusions and separate grains. Al was mostly present in metallic fragments on grains boundaries and also and as separate grains (often oxidised), moreover Al was important component of aluminosilicates and amorphous phase. Zn-rich metallic fragments were mostly in the form of separate grains. In complex composition of metallic fragments some regularities in elements co-occurrences were observed: Fe often co-existed with Si, Ca, P, Al and Ti; Al co-occurred with Fe, Si and Ca; Zn co-existed with Ca, Al and Si.

Forms and composition of metallic fragments allows to evaluate them as potential polymetallic resource, however an economically reasonable extraction techniques must be applied.

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Reference
Kowalski, P.R., Kasina, M. and Michalik M.: Metallic elements fractionation in municipal solid waste incineration residues, Energy Procedia, 97, 31-36, doi: 10.1016/j.egypro.2016.10.013, 2016.