New ceramic bricks based on pretreated MSW bottom ash

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Abstract

Recently several innovative suggestions how the municipal solid waste (MSW) can be utilized into new products have been presented in literature, e.g. as inert materials in cement or in ceramic materials as alternative fluxing agents.

In this paper we report preliminary results for the sintering process of new ceramic bricks based on kaolin and secondary raw materials (SRM), derived from Municipal Solid Waste Incinerators. The used MSW bottom ash, pretreated for iron and aluminum recovery, has been heated for 2 hours at 600°C to eliminate the residual organic phase. Then it was mixed with industrial clay, humidified and pressed. The effect of additions of small amounts of sodium carbonate and alumina in the batch was also investigated. The effect of composition and heat treatment temperature on the sintering process was studied by several techniques (optical dilatometry, hot-stage XRD and DTA-TG), whereas the formed crystalline phases were characterized by XRD and SEM-EDS. Moreover, the linear shrinkage, bulk density, porosity and water absorption were also measured.

The results highlighted that densification and intensive re-crystallization reactions between the meta-kaolinite from clay and the phases from bottom ash carried out in the range of 820-950°C. It was also demonstrated that the sodium oxide acts as a flux decreasing the sintering temperature and the temperature range of anorthite formation. Contrary the presence of Al_2O_3 leads to higher reaction temperatures, not affecting the crystal phase formation but decreasing the shrinkage rate. The final samples show technological parameters typical for the modern bricks production (low firing temperature, ~3% linear shrinkage and ~ 10% water absorption).

The results elucidate that pretreated MSW bottom ash could be recommended as raw material in the manufacture of new ceramic bricks, thus reducing the waste amounts disposed in landfills and the consumption of traditional raw materials.