

Vitrification of Bottom Ash from AVR MSW incinerators

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Abstract

During incineration of municipal solid waste (MSW), various environmentally harmful elements and heavy metals are liberated either into bottom ash, or carried away with the off-gases and subsequently trapped in fly-ash. If these minor but harmful elements are not properly isolated and immobilized, it can lead to secondary environmental pollution to the air, soil and water. The stricter environmental regulations to be implemented in the near future in the Netherlands require a higher immobilization efficiency of the bottom ash treatment. In the present study, MSW incinerator bottom ash was vitrified at higher temperatures and the slag formed and metal recovered were examined. The behaviour of soluble elements that remain in the slag is evaluated by leaching extraction. The thermodynamics of slag and metal formation is discussed. The results obtained can provide a valuable route to treat the ashes from incinerators, and to make recycling and more efficient utilization of the bottom ash possible.

1 Introduction

The Netherlands has 11 municipal solid waste (MSW) incineration plants with total incinerated waste of 5.18 mt, and generated about 1.1 mt bottom ash, 80 kt fly ash and 122 kt metals in 2003 [1]. AVR (Afvalverwerking Rijnmond) as the largest waste incinerator in the Netherlands has 3 incineration plants (Rozenburg, Rotterdam and Duiven) with an annual capacity of waste incineration of 1.85 mt. In 2003, AVR incinerated 1.84 mt solid wastes.

Bottom ash utilization in the Netherlands is about 100%, mainly in construction applications. To avoid the potential leaching of heavy metals from construction materials, the Dutch Government has developed a special legislation, the 'Dutch Building Materials Decree', in which the bottom ash is regarded as a special category, which requires isolation precautions before uses. Comparing to the column test results of category 2 material, bottom ash does not comply with emission limit values for Mo, Cu and Sb [2].

The use of bottom ash has to comply with stricter standard in the near future[1]. The growing restrictions regarding the emission of the secondary environmental harmful elements to the environment

require further development of a safer and economic bottom ash treatment. Various methods to process bottom ash were reported in the literature. The most important ways are ageing, clinker production, natural weathering, carbonation, mixing with cement or carbon rich binder from oil refining, inclusion in clay-based bricks or asphalt, and vitrification [3]. The extraction of pieces of metal from bottom ash of MSWI by magnetic and eddy current separation could be profitable. However, for fine metal particles, this process is limited.

Vitrification has the advantages of high destruction efficiency of organics and immobilization of environmental harmful elements. The disadvantage of the high temperature processing is the high energy cost. Through combining with metallurgical extractions, the vitrification is expected to be an attractive alternative for a sustainable long-term usage of bottom ash, if the value-added products (glassy slag, metal and secondary raw materials for heavy metal production) can be obtained.

Bottom ash is a very inhomogeneous product and the results of vitrification can vary. Therefore, the produced slag can differ in composition and in the level of immobilization. In the present work bottom ash from AVR is vitrified to analyze the solidified products. Leaching tests are conducted to determine