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MICROWAVE VITRIFICATION OF INDUSTRIAL WASTES

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This work presents the results of microwave energy application in waste treatment. At the Institute of Geotechnics, the considerable attention has been devoted to the research of different heavy metals carriers used in wastewater treatment in recent years [1]. Microwave vitrification has been used for stabilisation of heavy metals carriers.

The Albanian leaching residue is a waste coming from nickel production in hydrometallurgical plant in Sereď (Slovakia) and was used as a carrier of heavy metals (Pb, Ni, Cd) from wastewater treatment. This waste has a high content of magnetite (54 %), which is strong microwave absorber and this property can be used successfully as a microwave vitrification accelerator. The mixture of waste with raw materials (colourless container glass, andesite, dolomite, glass sand and soda) was stabilised by microwave vitrification. Before vitrification, the vitrificated samples were placed in thermal isolated ceramic crucibles. Microwave vitrification was carried out in the microwave oven Panasonic NN-Q543 (frequency 2450 MHz, output 1000 W) during 45 minutes.

The TCLP test was applied for testing chemical durability and Vicker`s indentation method for microhardness evaluation. The vitrificated samples proved good chemical durability, the measured values were under limit. The microhardness was measured in two different zones (matrix and white zones), which were identified in the pictures from light microscopy. The microhardness of vitrificates was between 6 and 7.25 GPa in basic matrix and from 8.98 to 11.51 GPa in white zones. The measured values are comparable with the values quoted in literature [2] for waste treatment of iron reached waste melted in a classic furnace.

The EDX measurements verified that the matrix mainly consist of Si (48.34 – 70.15 %), Fe (16.19 – 19.52 %) and Ca (5.74 – 13.89 %) and the white zones had higher concentration of Fe (39.47 – 89.69 %), Cr (0.25 – 45.99 %), Mg (2.19 – 4.01 %), Ni (2.28 – 6.03 %) and Si (1.33 – 22.89 %).

References

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[2] Romero M., Rawlings R.D., Rincon J.M.: Development of a New Glass-Ceramic by Means of Controlled Vitrification and Crystallisation of Inorganic Waste from Urban Incineration. Journal of the European Ceramic Society 19, pp. 2049-2058, 1999.