The IR Spectroscopy Studies of Alkaline Activated Slag Geopolymers

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The geopolimers are considered to be a group of modern aluminosilicate materials of compositions and properties which allow to apply them in many technologies. The possibility of applications of them as alternate binding materials instead of Portland cement occurs to be the most significant fact. In this work, the results of structural studies of different geopolimers, obtained by use of a granulated blast furnace slag, are presented. Slag was subjected to an alkaline activation process. As activators, NaOH, Na_2CO_3 and liquid glass were applied.

As a main investigating method, the IR spectroscopy was used, the results obtained were then compared with the NMR (^{29}Si i ^{27}Al MAS NMR) measurements, the XRD phase analysis and the SEM observations.

In the IR spectra of raw slag as well as in the spectra of products of paste and mortar hydration, bands due to the vibrations characteristic of bonds observed in both types of oxygen bridges: Si-O-Si and Si-O-Al, were assigned. Those bridges make basic structural units, creating then tetrahedral geopolimer chains. It was found, that the slag composition, first of all SiO_2/Al_2O_3 ratio and modifying oxides concentration, influences on the presence of the bands connected with the phases (C-S-H and zeolites, mainly) formed during the hydration, in the IR spectra. Additionally, it was found the essential influence of phases amorphous degree on the spectra shape. It is pointed by the parameters of the component bands, forming the complicated envelopes, during the decomposition process determined.

On the ground of the IR spectra, it was also possible to determine the influence of an activator type, an activation time and hydration conditions, on the products formed. The essential changes were observed for the bands assigned to carbonate and hydroxide groups vibrations. The changes were also noticed in case of bands due to the vibrations of silicate and aluminosilicate bonds vibrations.

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