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Green Alkali Activated Materials Based on The Different Precursors

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The main goal of this study was the evaluation of physical–chemical, as well as radiological properties of residual materials used for synthesis of alkali activated materials (AAMs) for the possible application as new materials in a civil engineering industry. Also, the purpose of this research was to investigate the hydrophobicity of new alumino-silicate materials and the influence of Si/Al ratio on their surface properties. Contact angle measurement (CAM) as reliable indicator of hydrophobicity was determined for synthesized AAMs using water and ethylene glycol as reference liquids.

Alkali-activated materials were synthesized from various precursors: kaolin, bentonite and diatomite. Characterization of phase structure and microstructure was performed by X-ray diffraction (XRD), Fourier transform infra-red (FTIR) spectroscopy, Scanning electron microscopy and Energy-dispersive X-ray (SEM/EDX) spectroscopy. Contact angle measurements confirmed that the alkali-activated materials synthesized from metakaolin are the most porous, which can be explained by the smallest Si/Al ratio. The maximum value of contact angle and free surface energy (110.2 mJ/m^2) has been achieved for alkali-activated materials synthesized by diatomite (GPMD). Concentration of ^{40}K and radionuclides from the ^{238}U and ^{232}Th decay series in waste precursors, their metaphases and AAM samples synthetized by alkali activation were determined together with corresponding absorbed dose rate ($\dot{D}$) and the annual effective dose rate. Natural activity concentrations in the alkali-activated materials were found to be lower than that of both residual materials and calcined ones.

Keywords: Alkali activated materials, metakaolin, contact angle measurement, absorbed dose rate