

Alkali Activated Materials Based on Natural Clay from Raciszyn

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Abstract : Limited resources of raw materials determine the necessity of obtaining materials from other sources. In this area, the most known and widespread are recycling processes, which are mainly focused on the reuse of material. Another possible solution used in various companies to achieve improvement in sustainable development is waste-free production. It involves the production exclusively from such materials, whose waste is included in the group of renewable raw materials. This means that they can: (i) be recycled directly during the manufacturing process of further products or (ii) be raw material obtained by other companies for the production of alternative products. The article presents the possibility of using post-production clay from the Jurassic limestone deposit "Raciszyn II" as a raw material for the production of alkali activated materials (AAM). Such products are currently increasingly used, mostly in various building applications. However, their final properties depend significantly on many factors; the most important of them are: chemical composition of the raw material, particle size, specific surface area, type and concentration of the activator and the temperature range of the heat treatment. Conducted mineralogical and chemical analyzes of clay from the "Raciszyn II" deposit confirmed that this material, due to its high content of aluminosilicates, can be used as raw material for the production of AAM. In order to obtain the product with the best properties, the optimization of the clay calcining process was also carried out. Based on the obtained results, it was found that this process should occur in the range between 750 oC and 800 oC. The use of a lower temperature causes getting a raw material with low metakaolin content which is the main component of materials suitable for alkaline activation processes. On the other hand, higher heat treatment temperatures cause thermal dissociation of large amounts of calcite, which is associated with the release of large amounts of CO₂ and the formation of calcium oxide. This compound significantly accelerates the binding process, which consequently often prevents the correct formation of geopolymer mass. The effect of the use of various activators: (i) NaOH, (ii) KOH and (iii) a mixture of KOH to NaOH in a ratio of 10%, 25% and 50% by volume on the compressive strength of the AAM was also analyzed. Obtained results depending on the activator used were in the range from 25 MPa to 40 MPa. These values are comparable with the results obtained for materials produced on the basis of Portland cement, which is one of the most popular building materials.

Keywords : alkaline activation, aluminosilicates, calcination, compressive strength

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