INFLUENCE OF GRANITE CUTTING WASTE ON THE FORMATION OF DIBASIC CALCIUM SILICATE HYDRATES

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High energy costs, CO_2 emissions, and limited resources are forcing the concrete industry to look for new ways to develop sustainable and environmentally friendly production. There are several ways to reduce the negative impact on nature, while the production of environmentally friendly cement by using industrial wastes is the most effective way. For example, environmentally friendly cement such as "Solidia" and "Celitement" allows to reduce the emission of carbon dioxide up to 70% in comparison to Portland cement. "Solidia" and "Celitement" can be produced by two-step synthesis: 1) hydrothermal synthesis of calcium silicates hydrates (CSH); 2) mechanochemical activation and/or thermal treatment at low temperatures (<1000 °C) of CSH. The properties of these cement depend on the mineralogical composition and properties of precursors. However, the scientific literature containing the data about the influence of industrial waste on the formation of CSH is scarce. Thus, this work aimed to determine the influence of granite cutting waste additive on the formation of calcium silicate hydrates during hydrothermal synthesis at 200 °C temperature.

For the synthesis of calcium silicate hydrates, the mixture of calcium oxide and silicon dioxide (CaO/SiO_2=1.5) was prepared. In order to determine the influence of granite cutting waste on the formation of CSH in the second mixture 5% of calcium oxide was replaced by granite cutting waste. The hydrothermal synthesis of CSH has been carried out in unstirred suspensions in an autoclave under the saturated steam pressure at 200 °C when the duration of synthesis was equal to 16 h, 48 h, and 72 h.

It was determined that α-C_2SH together with low basicity calcium silicate hydrates – xonotlite and tobermorite were formed in the pure system after 16 h of synthesis. Also, unreacted quartz and calcium carbonate, which formed due to the carbonization of synthesis products, were identified. The quantity of the latter compounds decreased by increasing the duration of synthesis to 72 h. It was established that the 5% replacement of calcium oxide by granite cutting waste strongly affects the mineralogical composition of synthesis products. The results of XRD analysis showed that at the beginning of synthesis scawtite and tobermorite were formed. Meanwhile at the end of synthesis (72 h) xonotlite, scawtite, and tobermorite were the main phases in the products.

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