THE POSSIBILITY OF OBTAINING BETA-ANHYDRITE FROM WASTE NITROGYPSUM

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It was investigated the possibility of obtaining $\beta$-anhydrite from nitrogypsum, which is waste from a nitrocellulose plant. By means of qualitative IR analysis it was stated that the product obtained by heating nitrogypsum 5 hours at 700 °C was $\beta$-anhydrite. When $\beta$-anhydrite was mixed with water at a W/P (water/powder) ratio 0.54, in presence of different accelerators (CaO, mixture CaO - ash, ash, Na$_2$SO$_4$ and K$_2$SO$_4$), pastes were formed which hardened by standing. The compressive strength of the hardened samples was measured after 7 and 28 days and their composition determined by qualitative IR analysis.

The experimental results showed that $\beta$-anhydrite ($\beta$-CaSO$_4$) completely recrystallized to dihydrate (CaSO$_4$·2H$_2$O) and that the double salt syngenite (K$_2$SO$_4$·CaSO$_4$·H$_2$O) formed in the sample prepared in the presence of K$_2$SO$_4$ after 7 days. This sample was very resistant to compression and its compression strength (11.04 MPa) exceeded the highest value provided for anhydrite cement (according GOST 2767-44). The composition and the compressive strength of mentioned sample didn’t change after 28 days.

In the second sample, prepared in the presence of Na$_2$SO$_4$, $\beta$-anhydrite converted to dihydrate incompletely after 7, but completely after 28 days. In addition to that the presence of a double salt glauberite (Na$_2$SO$_4$·CaSO$_4$) was stated (both after 7 and 28 days). The compression strength of this sample was raised from 8.45 MPa (after 7 days) to 12.14 MPa (after 28 days).

In all other samples (prepared in presence of the accelerators: CaO, mixture CaO - ash as well as ash) the transformation of $\beta$-anhydrite was incompletely, neither after 7, nor after 28 days. Also, $\beta$-anhydrite didn’t transform to CaSO$_4$·2H$_2$O, but to crystallohydrate of indefinite composition (CaSO$_4$·XH$_2$O). The compression strength of these samples was low (both after 7 and 28 days), lower than the lowest value required for anhydrite cement (GOST 2767 - 44).

On the basis of the mentioned results it was noticed that there is the relationship between the chemical composition (depending on used accelerator) and the compression strength of the samples. Namely, the formation of large cores of double salts: syngenite (K$_2$SO$_4$·CaSO$_4$·H$_2$O) and glauberite (Na$_2$SO$_4$·CaSO$_4$), in the presence of accelerators: K$_2$SO$_4$ and Na$_2$SO$_4$ respectively, was due to the rapid and complete crystallization of dihydrate (CaSO$_4$·2H$_2$O). This fast crystal growth of dihydrate resulted in the high compressive strength of these samples. In the other samples (prepared in presence of accelerators: CaO, mixture CaO – ash and ash), dihydrate didn’t form and consequently their compressive strength was low.

$\beta$-Anhydrite, obtained in this work from waste nitrogypsum, could be used for anhydrite cement preparation in the presence of appropriate accelerators (K$_2$SO$_4$ and Na$_2$SO$_4$).