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Physical and Chemical Studies of High-Strength and Water-Resistant Composite Gypsum Binder

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ABSTRACT: This article has shown of using gypsum materials in construction process. Also, there are some analyzing results which are covered negative properties and methods of improving resistant of this material. Research results show that peak temperature influenced on binder and modification by weight. There are some important figures which are illustrated DTA superplasticizer,their mechanical mixtures, radiographs, infrared spectra and electron spectroscopy of gypsum.

KEYWORDS: gypsum, gypsum composite superplasticizer C-3, water resistance, differential thermal analysis, X-ray diffraction, electron microscopy

I.INTRODUCTION

The use of gypsum materials in the construction does not match their potential. This is due to several inherent negative properties: high humidity molding using gypsum binder β-modification and, consequently, low water resistance, considerable creep when wet, and other low frost.

Currently available methods for improving water resistance and other properties of gypsum binders do not fully eliminate these defects, which reduces their effectiveness and prevents widespread use in construction.

Various methods for improving these properties of gypsum products, particularly water-resistant, yet their use in construction is insufficient.

At the same time in Uzbekistan the total volume of gypsum binders increases; effective range of plaster materials and products, as a result of low physical and mechanical properties is not sufficient.

Therefore, the development of qualitatively new and modified composite structures with active silica additives gypsum binders, provides a wide range of products with high physical-mechanical, operational, and technical and economic indicators is an urgent task.

Low water resistance of gypsum products and materials caused by the solubility of calcium sulphatedihydrate in water. It is noted that primarily, calcium sulphatedihydrate dissolved in places of contacts of crystalline splices, due to the increased solubility of the latter in comparison with well-formed crystals strained.

From the standpoint of thermodynamics laws crystallization contacts due to lattice formed have an excess of free energy, and consequently, increased solubility. However, a specific interest are the data showing that the decline of strength of gypsum when moistened to 65-75% water explained wedging action and only 12-15% of the strength is lost in the process of dissolution of crystals of calcium sulphatedihydrate in water [1,2].

From these data, it can be concluded that the water resistance of gypsum is significantly affected by the volume of its porosity and pore size characteristics. Thus, natural gypsum, which is characterized by a dense structure (water absorption of not more than 4.3%) is considered fairly water resistant material, since its softening ratio exceeds 0.6 [3].

Reduced W/Gfor the preparation of a gypsum mixture leads to the formation of structures with lower porosity and hence greater resistance to water. According to [4], the samples obtained from the W / G= 0.5 after 12 hours of testing on vodorazmyvaemost, lost in the mass of 52.4%, and manufactured at W / G = 0.7 - completely eroded

Thus, recognizing a role in the low water resistance of gypsum materials highly soluble calcium sulfate dihydrate in water, it is impossible not to note the fact of significant effect of pore space gypsum.

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II. RESEARCH RESULTS

The DTA samples of gypsum binder oflow water (GBLW) the ratio between the areas and the exothermic peak temperature of the maximum superplasticizer C-3 is changed. (Fig. 1).

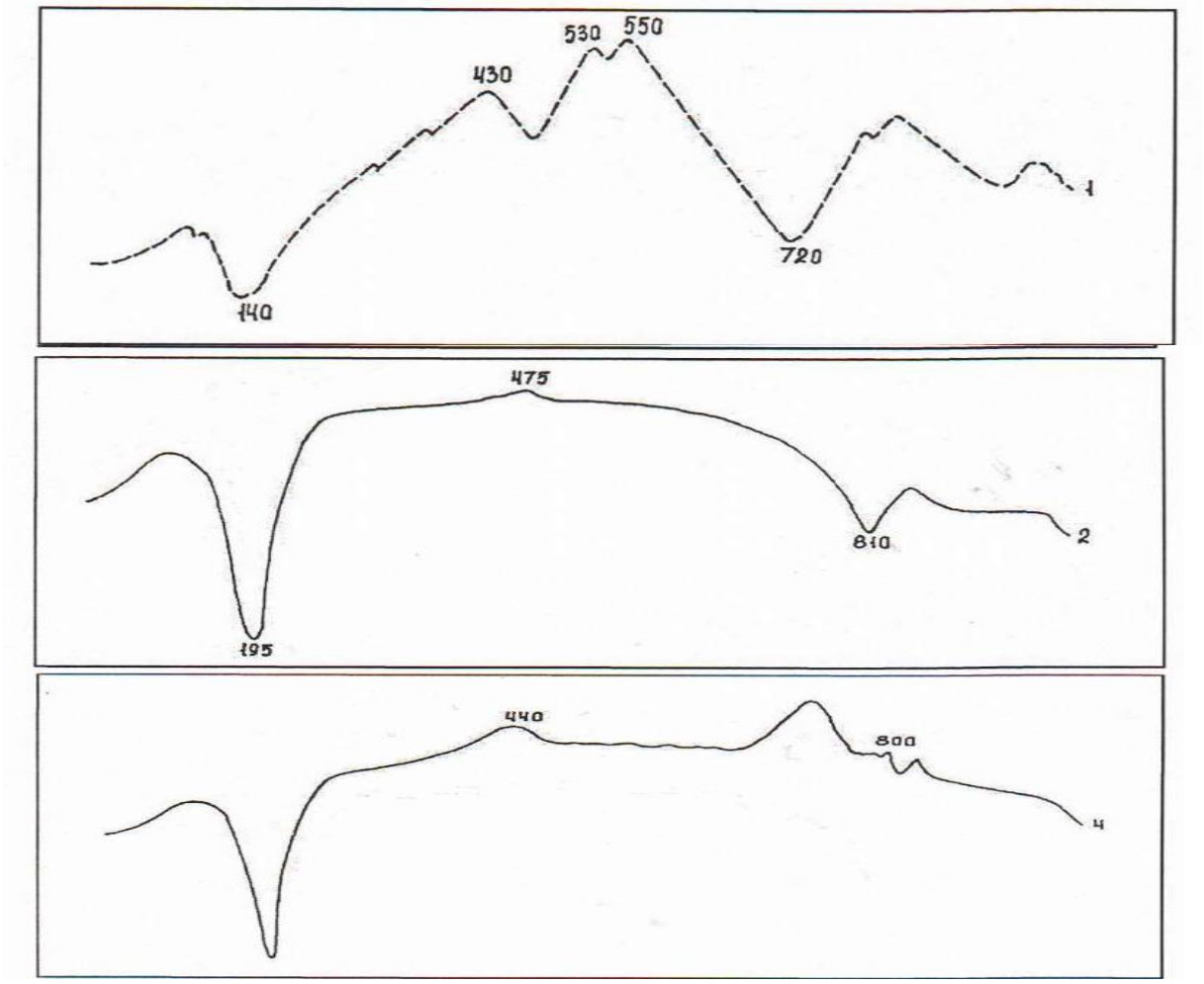

Fig.1. DTA superplasticizer C - 3 (1), gypsum binder (2), their mechanical mixtures in a ratio of 2: 100 (3) and GBLW (4)

Interaction of molecules polymethylenenaftalinsulfanata (active substance superplasticizer - 3) with a plaster binder occurs on the surface of the material in which the crystal lattice parameters of the calcium sulfate hemihydrate does not change, as evidenced by X-ray diffraction patterns (Fig 2.) And the data of infrared spectroscopy (see Figure 3.).

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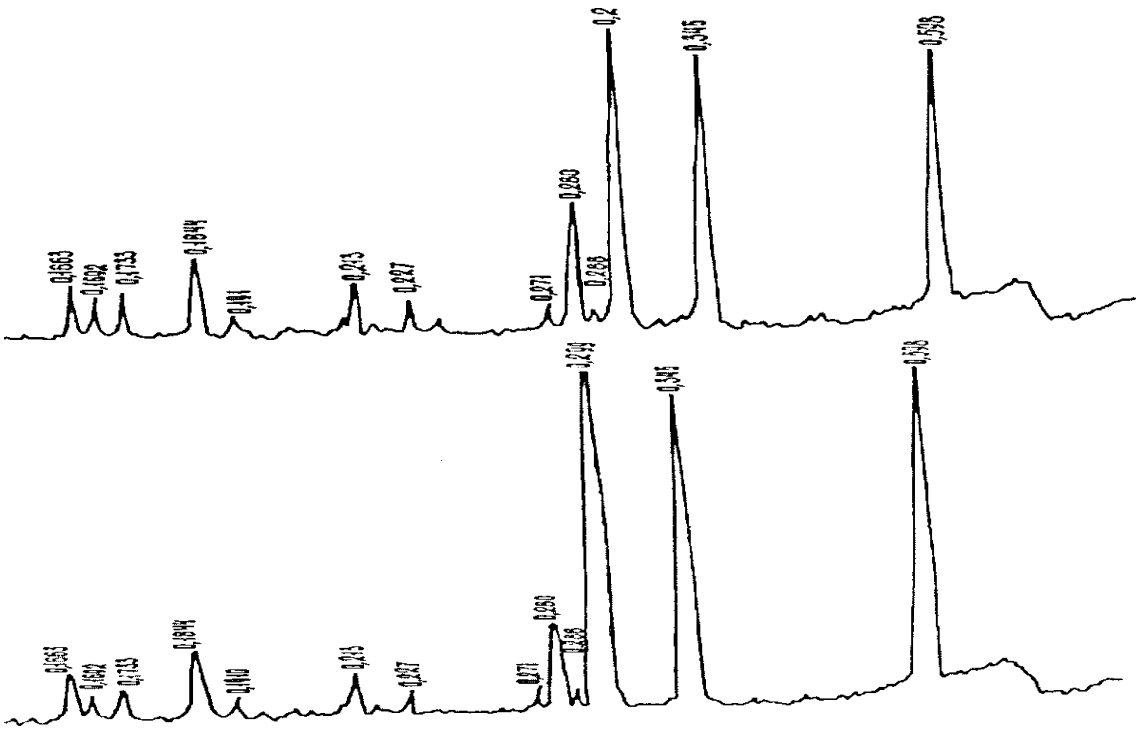

Fig. 2. Radiographs gypsum binder and modification (1), with 1% GBLW (2) and 2% (3) C-3 superplasticizer by weight.

Polymer fraction corresponding compounds with a number average molecular weight n> 2300 Medium - with n = 1200 - 2100, the light fraction comprises compounds having n of from 230 to 900 daltons.

Data obtained using electron spectroscopy, diffuse reflectance ultraviolet waves from the surface of the material (Figure 4) allow to confirm the accuracy of previous findings regarding the interaction of the end results with the P-3 a gypsum binder in the process of co-milling, in particular, the degradation of the surfactant molecules and their chemical interaction with binders and suggests a possible layout of surfactant molecules (when administered in an amount of up to 2%) to the binder particles. On the destruction of the surfactant molecules may indicate an increase in resolution of the spectrum GBLW samples with 2% C-3, which is observed in a model sample GBLW 8% additives.

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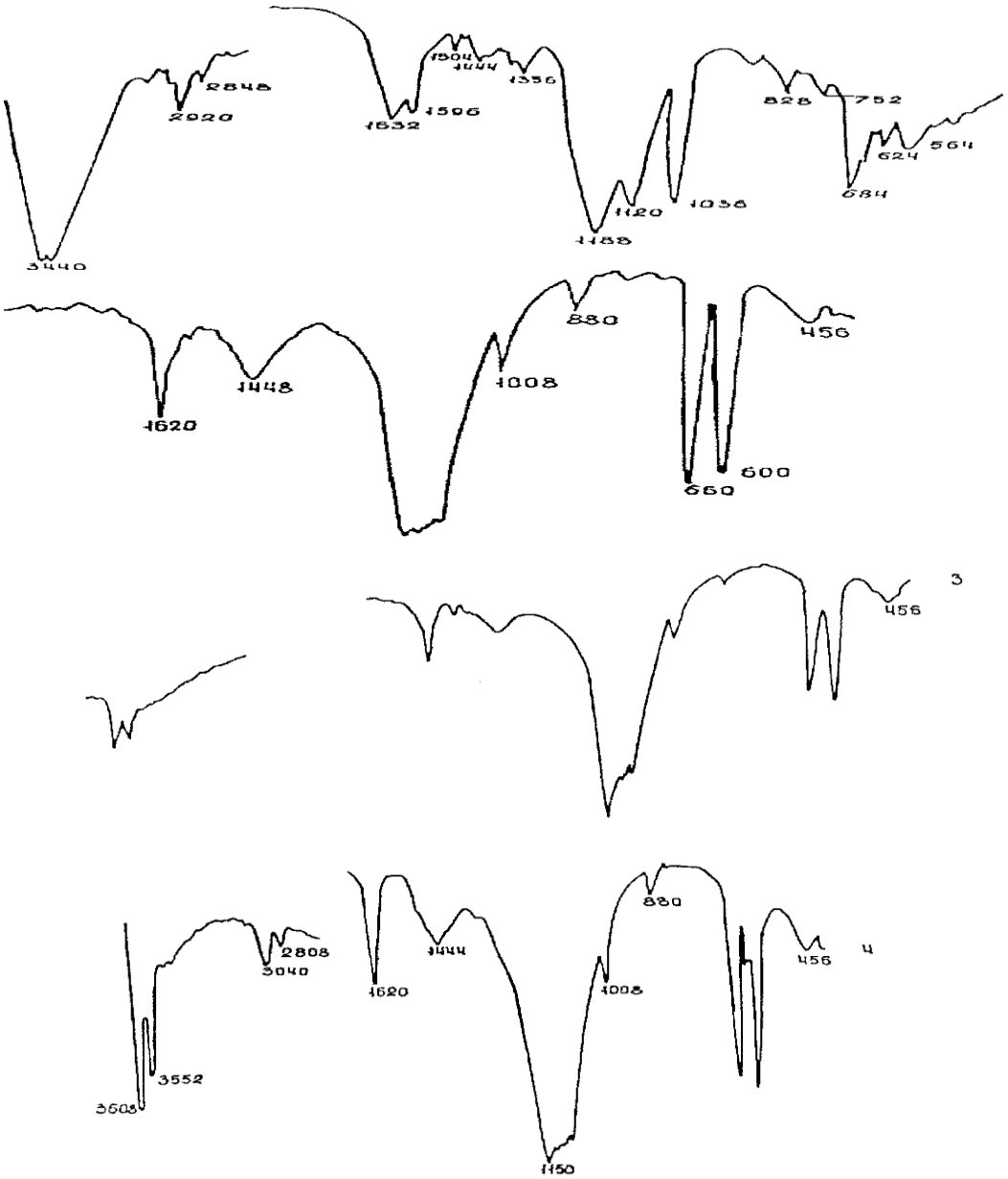

Figure 3. Infrared spectra superplasticizer C-3 (1), gypsum binder and the modification (2), with GBLW 2 (3) and 8% - 3 (4) by weight About surfactant chemical interaction with the fact of gypsum binders can be judged by the redistribution of the absorption bands of ultraviolet wave lengths at 275 and 310 nm on GBLW samples with 2% C-3. Thus, at a wavelength of 275 nm, the absorption intensity increases, and when λ = 310 nm, on the contrary, the absorption intensity at curve hardly visible.

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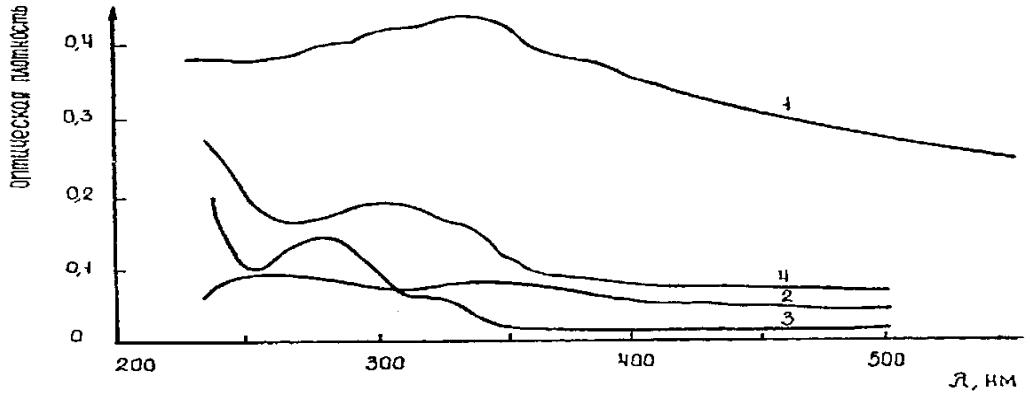

Figure 4. Electron spectroscopy of diffuse reflection from the surface of the ultraviolet waves for superplasticizer C-3 (1), gypsum binder (2) GBLW 2 and 8% - 3 (4) by weight.

Thus, the nature of the absorption bands presented in Fig. 2, the following conclusion can be made: The surface of the particles GBLW 8% dense solid additive coated PNS multimolecular layer of molecules, while the last character of distribution on the surface GBLW with 2% C-3 is intermittent. This indicates that a substantial part of the additive diffuses into the binder. It can be assumed that the active sites on hemosorbirovanie surfactant binder molecules, the binder in abrasion points, "flow" together with them trapped inside the particles formed, as it were, "welding" with them.

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