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DEVELOPMENT OF MODERN SCIENCE
UNDER GLOBAL CHANGES

held in Riga, Latvia, May 22, 2020

Izdevniecība "BALTIJA PUBLISHING" LATVIJA RIGA Reģ. Nr. 40103...

Anita Jankovska
Managing Editor,
Publishing house «Baltija Publishing»

IZDEVNIECĪBA
BALTIJA
PUBLISHING

INTERNATIONAL SCIENTIFIC CONFERENCE

DEVELOPMENT OF MODERN SCIENCE UNDER GLOBAL CHANGES

May 22th, 2020

Proceedings of the Conference

Riga, Latvia
2020

UDK 001(062)
De933

International Scientific Conference **Development of Modern Science Under Global Changes**: Conference Proceedings, 22th May, 2020. Riga, Latvia: Baltija Publishing. 104 pages.

ISBN: 978-9934-588-52-5

DOI: https://doi.org/10.30525/978-9934-588-52-5

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INVESTIGATING THE EFFECT OF PLASTICIZERS ON STRUCTURE FORMATION OF GYPSUM BASED SYSTEMS

Hanna Hryshko[1]

DOI: https://doi.org/10.30525/978-9934-588-52-5-22

Relevance. Relevance of using gypsum binders is that their production requires extremely low energy consumption and the hydration process can be controlled broadly. Besides, the single-phase structure significantly simplifies the product manufacturing technology. These advantages encourage researchers to proceed with further attempts to obtain a gypsum structure exhibiting the properties of cement binders. One of the trends is the study of impact of additives on the hydration processes of gypsum binders.

Problem statement. Structure formation process generally depends on the initial content of binding substances interacting during the hydration process. The analysis of technical publications shows that production of composite binders is a priority in the manufacture of mineral binders [1, p. 15; 2, p. 217; 3, p. 291; 4, p. 104]. The second trend is the use of various additives and factors affecting the hydration process [1, p. 41].

One of these factors is an increased interfacial surface energy arising in 'binder-water' systems [5, p. 577; 6, p. 93].

However, most studies involving additives were focused on trying to structure gypsum and cement materials in order to obtain products with enhanced structural and physical, physical and mechanical as well as engineering and performance properties.

The analysis of publications conducted by the authors showed a lack of information on reliable mechanisms of hydration processes of mineral binding substances in the presence of modifiers.

Purpose of the Article. To assess the effects of surfactants on the hydration process, structure formation and main physical and mechanical properties of mineral binding substances.

According to the purpose, the research program involves exploring the structure of gypsum binder formed with minimal impact of other factors. Counterdiffusion crystal growth technique was applied for this reason using solutions of $CaCl_2$, Na_2SO_4, and H_2O.

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The second research technique includes counterdiffusion growth of gypsum crystals in the presence of surfactants, i.e., the effects of surfactants on the structure and properties of hydrated gypsum and cement binders.

Conclusion. The studies conducted helped identify the effects of surfactants on the structure and properties of hydrated gypsum binder and cement binder; furthermore, the most effective additives were identified allowing to reduce water-to-gypsum ratio significantly, improve strength values and obtain a binder with a higher density structure.

If crystals are grown using a solution of $CaCI_2+Na_2SO_4+2H_2O\rightarrow CaSO_4\cdot 2H_2O+2NaCl$, gypsum specimens will have a high-porosity fibrous microstructure.

As a result of counterdiffusion growth of gypsum crystals in the presence of surfactants, filling of interlayer voids can be observed in the microphotographs. Furthermore, the crystals shape and size begin to change as well as the framework structure and strength (Figure 1).

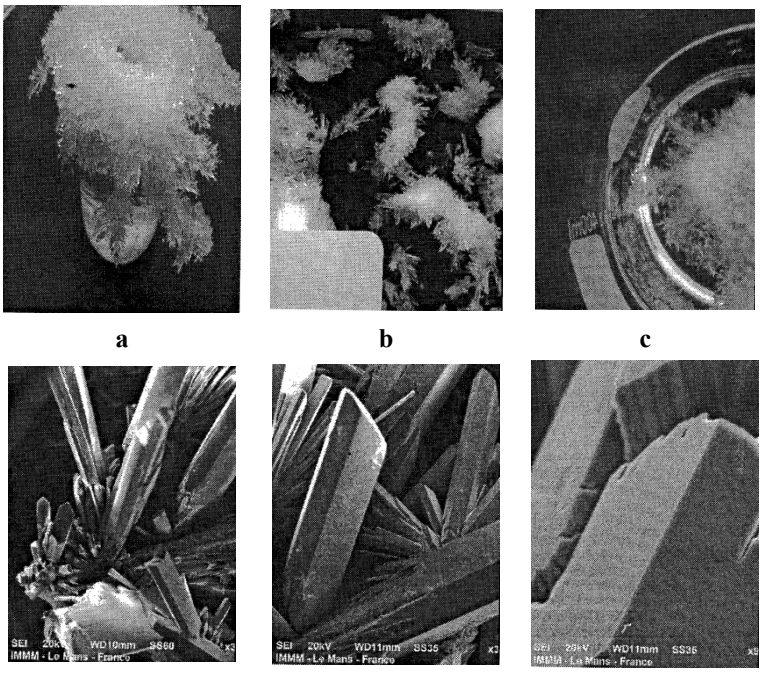

Figure 1. Photos (Figure 1 a, b, c) and micrographs (Figure 1 d, e, f) of crystals grown in the medium containing ACE 430 plasticizer

The main factors are the nucleation rate of facial surface energy and solution concentration. The best results have been achieved with Sika and ACE 430 plasticizers.

Modifying the initial cement binder with a superplasticizer additive results in a reduced normal density of cement paste, reduced W/C ratio, increased ultimate compressive and bending strength values both at an early and mature ages.

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participants – scientists, engineers, designers, employees – are interested in the rapid and cost-effective implementation of research and development results into production. Many countries engage in «poaching» of highly qualified scientific personnel, which allows them to develop innovative entrepreneurship at a lower cost and faster pace. The survival of any business structure depends most directly on the intellectual activity of its staff. According to domestic scientists, personal benefit is a powerful stimulus for accelerating the new product models development and increasing production efficiency.

Economic conditions for creative work are provided through appropriate material incentives in various forms: through payment and bonuses system; providing social benefits; profit sharing system; property ownership, etc. Among the nonfinancial incentives of particular importance is employees' creative activity stimulation. Creativity is usually manifested through the spontaneous demonstration of creativity at the right time and is an original perception of the problem and finding a non-trivial answer through action or communication in a relaxed atmosphere. A harmonious environment involves ensuring not only an individual acceptance, but also team members stimulation as a whole.

Thus, nowadays stimulating innovative activities is an essential element of state economic policy, since a country's competitiveness depends largely on the efficient functioning of industrial enterprises and their susceptibility to innovations.

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Izdevniecība “Baltija Publishing”
Valdeķu iela 62 – 156, Rīga, LV-1058
E-mail: office@baltijapublishing.lv

Iespiests tipogrāfijā SIA “Izdevniecība “Baltija Publishing”
Parakstīts iespiešanai: 2020. gada 29 maijs
Tirāža 100 eks.