

Methods Improving Operational Properties of Building Materials

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Abstract

Criteria approach is proposed to determine the rational modification of building composites for general and special purpose. Composite index takes into account the following specific criteria: stability criterion properties, thermodynamic stability criterion modifier, the criterion of formation of thermodynamically stable structures of building materials, the criterion of technological support technology modification, the criterion of technology development.

Keywords: nanotechnology, the direction of modification, generalized criterion

1 Introduction

At present, the possibility of scientists on the use of nanotechnology, materials science in the development of a new generation of building materials and modification of traditional composites are very limited. In addition, the construction industry with all the infrastructure can provide only the production of building materials on the "bulk" technology.

Here it is advisable to quote the Harvard University professor D. Vaytsayda, which indicates that the creation of materials with different properties of nanoscale features of the structure are not always the determining factor. For most

materials, especially bulk, it is advisable to consider the different levels of the structure from the nanometer to millimeter and understand that they are closely linked. In some cases, determining fragments are not nano- and micrometer-sized and therefore in general should seek to create materials with the optimal size of the fragments in their structure defining functional or structural properties.

This approach develops a considerable time in building materials. Developed a variety of ways to control the structure formation of composite materials at the molecular level, which should be considered as nanomodifitsirovanie structure of building materials in order to create the optimal size of structural fragments.

It is advisable to highlight three areas in technology nanomodifitsirovaniya:

- 1) Changes in the structure of water, which is the equivalent component of building materials hydrate hardening. When this is achieved by changing the hydration rate, morphology and density structure of the neoplasm;

- 2) Change the crystal and supramolecular structures. This direction is common for all construction materials such as hydrated composite curing and composites for polymer binders;

- 3) Modification of the crystal structure. The last line is not a special case of the second direction, and is aimed at developing methods for process control recrystallization tumors, that is, during or after the hydration of the binder.

2 Experimental study

To determine the direction of rational modification of building composites for general and special purposes, it is advisable to use the criteria approach. For the purpose of solving the uncertainty in the formulation of generalized selection criterion we use the hypothesis of a linear convolution [1]. It is also necessary to formulate requirements to particular criteria. Summarizing the analytical information, it is proposed to allocate (table 1):

- 1) stability criteria for properties;
- 2) thermodynamic stability criterion modifier;
- 3) criterion formation of thermodynamically stable structures of building materials;
- 4) criterion technological support technology modification;
- 5) criterion technology development.

Table 1: Criteria for selecting the direction of modification building composites

№	Name criterion	Calculated formula	Explanations
1.	Stability criteria for properties	k_s	$k_s=0,5$ – if the method gives significant statistical dispersion of data; $k_s=1,0$ – if the method provides a statistically homogeneous results.
2.	Thermodynamic stability criterion modifier	k_{ts}	$k_{ts}=0,5$ – thermodynamically unstable systems and structures; $k_{ts}=1,0$ – for thermodynamically stable systems and structures
3.	Criterion formation of thermodynamically stable structures of building materials	k_{ss}	$k_{ss}=0,5$ – the formation of thermodynamically unstable structures; $k_{ss}=1,0$ – in the formation of stable structures.
4.	Criterion technological support technology modification	k_t	$k_t=1,0$ – technology is realized with conventional equipment; $k_t=0,75$ – technology is implemented by using a small amount of additional equipment; $k_t=0,5$ – technology has significant difficulty when using.
5.	Criterion technology development	k_d	$k_d=0,5$ – technology has no development; $k_d=1,0$ – technology has the potential for development.

Generalized criterion for selecting the direction of the modification should be presented in the form of:

$$k_{ef} = \sqrt[5]{k_s \cdot k_{ts} \cdot k_{ss} \cdot k_t \cdot k_d}$$

3 Results and discussion

The value of private and generalized criteria determined using expert method. The results obtained are summarized in table 2.

Table 2: Values of partial and generalized criteria to select the direction of modifying building composites

Name of the method		The values of the partial criteria					The value of the generalized criterion
		k_s	k_{ts}	k_{ss}	k_t	k_d	
Molecular changes in the structure of water							
Chemical	the introduction of water-soluble salts	1	1	1	1	0,5	0,87
	adding organic compounds	1	1	1	0,75	0,5	0,82
Physical	mechanical activation (application variable pressure)	0,5	0,5	0,5	0,5	0,5	0,50
	magnetic treatment (constant or variable magnetic field)	0,5	0,5	0,5	0,5	0,5	0,50
	electromagnetic activation (saturation of water with metal ions)	0,5	0,5	1	0,75	0,5	0,62
Physical and chemical	the introduction of nano-carbon structures (nanotubes astrolenov, fullerenes, including water-soluble)	1	1	1	0,5	1	0,87
	magnetic treatment of electrolyte solutions or colloidal solutions of nanocarbon structures	1	1	0,5	0,75	1	0,82
Modification of the crystal and supramolecular structures							
Physical	the addition of ultrafine chemically inert fillers, and other nanocarbon nanomodifiers (nucleating stress concentrators)	1	1	1	0,75	1	0,94

Table 2: (Continued): Values of partial and generalized criteria to select the direction of modifying building composites

Name of the method		The values of the partial criteria					The value of the generalized criterion
		k_s	k_{ts}	k_{ss}	k_t	k_d	
	structure formation in a magnetic field (the phenomenon of magnetostriction)	1	1	1	0,75	1	0,94
Physical and chemical	introduction of polymeric compounds (formation of structural network polymers)	1	1	1	0,75	1	0,94
	adding reactive fillers (solvate formation layers nucleating reinforcements)	1	1	1	0,75	0,5	0,82
Modification of the crystal structure of							
Physical and chemical	introduction of polymer compounds adsorbed on ultra-crystallization and polymerization products in the pore solution	1	1	1	0,75	1	0,94

4 Conclusion

Analysis of table 2 shows that the modification of the structure and management of the properties of composites for general construction and special purpose appropriate to apply:

- addition of ultrafine chemically inert fillers, and other nanocarbon nano-modifiers;
- structure formation in a magnetic field;
- the introduction of polymer compounds for the formation of structural network polymers;
- the introduction of polymer compounds adsorbed on ultra-crystallization and polymerization products in the pore solution.

References

- [1] N.N. Moiseev, Mathematical problems of system analysis. M.: Nauka, 1981. 488 p.

Received: January 17, 2015; Published: February 20, 2015