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Properties of geopolymer materials suitable for normalized tests

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Use of geopolymers:

- construction materials;
- dry mixtures for restoration stone, ceramics and terracotta;
- high-efficient heat-resistant insulators;
- heating panels;
- frost resistance materials;
- sound absorption panels and walls;
- geopolymer composites;
- means for liquidation of toxic metals, radioactive and hazardous wastes.



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Test of durability of geopolymer material





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Geopolymer wall tiles installed in 2002 on the house





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View after 5 years





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Other view after 5 years





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View after 10 years





Unique features of geopolymer materials

A) heat resistance:

- fire resistance,
- heat resistance at temperatures above 1000 °C (no gas products),
- temperature-change resistance,
- variable thermal conductivity (thermal conductivity coefficient λ :
 λ below 0.25 W / m / K, contrary, λ near to 1 W / m / K);

B) frost resistance;

C) sound absorption (range of 1000 – 2000 Hz);



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Unique features of geopolymer materials

D) stability:

- long-term volume stability,
- stability in colours (proved with inorganic pigments);

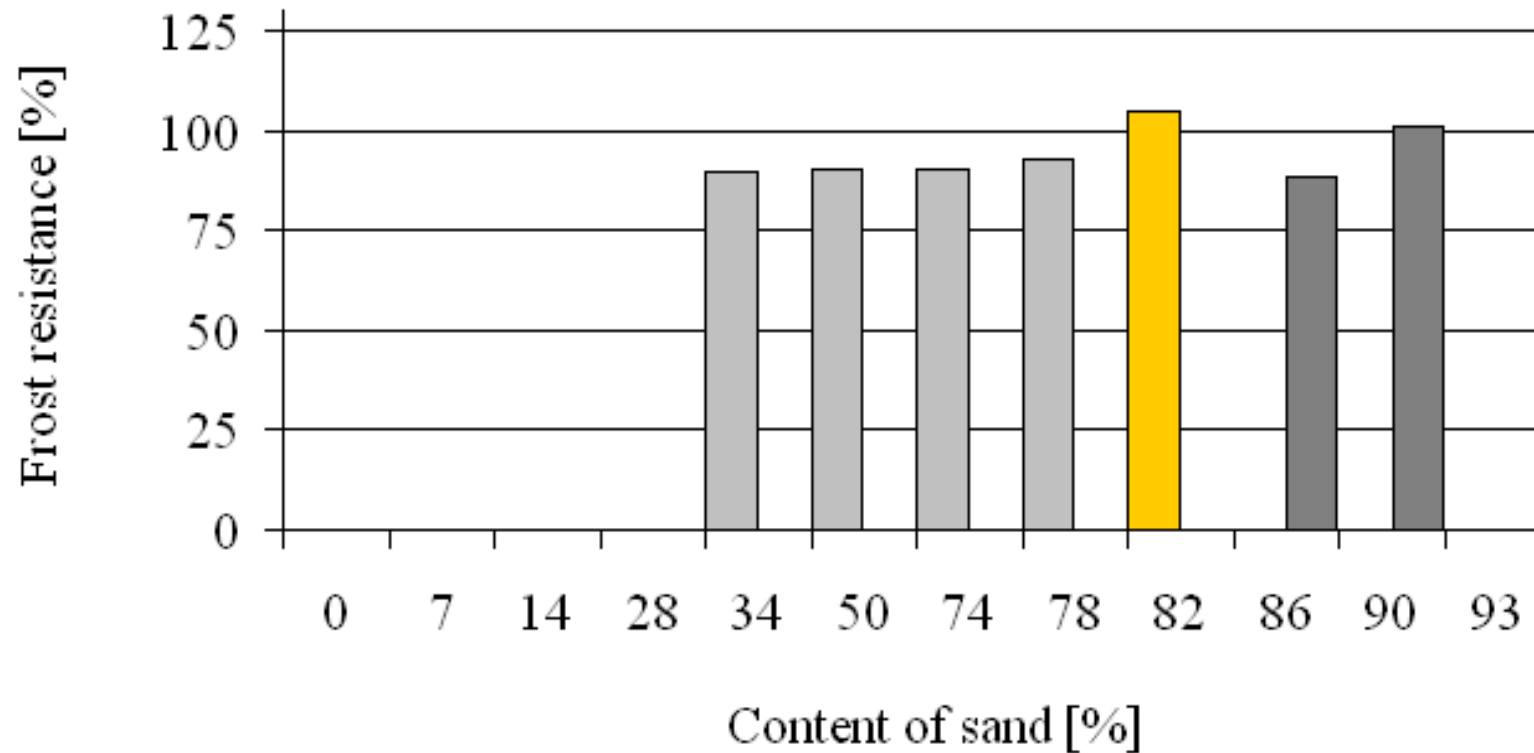
E) broad affinities of components:

- affinity of binder to fillers (sand, sandstone, limestone, marl, slate, basalt),
- affinity to additives (wood, paper, textile, plastics, metals, radioactive matters, carbonaceous materials etc.),
- material exclusivity (unique dry mixtures and special composites for restoration of stone and ceramics, laminated-board materials).



Frost resistance: 85 – 95 %

Frost resistance of geopolymer mortars





The norms for evaluation of geopolymer materials

- **1st group**: terminology of geopolymers, geopolymer materials and composites;
- **2nd group**: the norms quantifying physical properties and chosen utility properties, taken from norms for construction materials: density, volume weight, compressive strength, tensile strength, Young's modulus and other mechanical values; further, sound absorption; further, gas- and steam permeability, efflorescence, color stability;



The norms for evaluation of geopolymer materials

- **3rd group**: newly created norms: fire resistance, heat resistance at temperatures above 1000°C, temperature-change resistance, frost resistance, thermal conductivity coefficient, specific thermal capacity; suitability for the restoration of the individual kinds of stone and ceramics;
- **4th group**: special norms: liquidation of used radiation emitters, radioactive wastes and heavy or toxic metals, radiation protection materials, and impact on the environment.



Summary

1. A higher price of the geopolymer binder in comparison with cement speaks against the application.
2. This drawback can be compensated by excellent and normalized physical and chemical properties of the geopolymer materials, further, by the extent of applications, and by the possibility of producing dry exclusive mixtures for restoration of stone and ceramics.