hydrothermal stage yields the formation of bornite and covellite on chalcopyrite but also of hematite (specularite) on magnetite.

Use of the optical porosimetry for monitoring of deteriorative laboratory tests impacts on natural and agglomerated stone

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Determination of the resistance against freezing water and salt crystallization are two important standard deteriorative tests of building or decorative stones. These tests partially simulate the influence of weather and polluted environment on rocks and check their durability. Impact of the tests on the pore structure of selected natural and agglomerated stone types have been studied by means of optical porosimetry. The optical porosimetry is a technique of a detailed study of porosity in discountinuous materials. Dried porous samples were fully saturated with blue coloured resin, and after hardening, thin cuts were prepared. Effective pores could be well recognized by the colour in thin cuts under microscope (visual analysis - VAO), but also in pictures taken by a digital camera, that were statistically analysed by the computer (digital analysis - DAO). Visual and digital analyses have been carried out before and after the frost resistance tests (25 cycles of freezing/thawing) and before and after the salt crystallisation tests (15 cycles of immersion into a salt solution and drying). Mineral composition, pore network, and selected physical properties have been studied on both, untreated samples and on samples after mentioned laboratory destructive tests. Changes in rock microstructure predominantly in the pore network due to laboratory weathering tests were identified and illustrated.

Seven types of sandstones from a territory of Slovakia, one type of rhyolite and of travertine, as well as one type of agglomerated stone VASPO simulative various types of natural stones (a Slovak product widely used as exterior and interior cladding stone) have been selected for the research.

Optical porosimetry analyses refer to both realised laboratory tests had destructive effects on studied stones. The degradation due to the salt crystallization was more intensive. The used salt was hydrate phase of sodium sulphate, mirabilite ($Na_2SO_4.10H_2O$). According to VAO, micro-cracks were formed, predominantly near the samples surface, pore spaces were enlarged by chemical dissolution of some minerals reacting with the salt solution and existing fractures were opened. These visual signs of the stone decay and weakening were confirmed by changes of physical-mechanical properties after tests. Changes in values of total porosity, water absorption, velocity of ultrasonic pulses and uniaxial compressive strength were recorded.

Statistical parameters determined by DAO, i. e. total optical porosity, size-count parameters and erode-dilate parameters, confirmed changes in the rock pore networks after laboratory deteriorative tests.

In general, presented results of both, visual and digital porosity analyses after laboratory degradation tests demonstrate the applicability of the optical porosimetry method in a research of weathering of natural and agglomerated stones or building stone generally, under experimental or natural conditions, especially in cases when the effective (open) porosity of stones is higher than 5 %. More accentuated visual readable demonstrations require the realization a greater number of cycles of freezing/thawing than have been realized in our research.

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