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Investigation of water diffusion in porous materials by thermal conductivity sensor.

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Transport of water through pore structure of rocks represents a complex process. Coexistence of different phases, its mutual interaction as well as interaction with pore surfaces strongly influence the water transport through rocks. Present work contributes to the understanding of various phenomenons that accompany water transport through porous structures. Sandstone (porosity 18%) and marble (porosity 0.3%) were chosen for investigation of water diffusion. Blocks in size of 50x50x100 mm with impermeable lateral surfaces and opened bottom and upper surfaces were prepared for investigation of the one-dimensional water diffusion. Thermal conductivity sensors in a form of small balls (diameter around 2 mm) were inserted into block in different positions along the diffusion path. Bottom surface of the block was kept in water while upper surface was kept in free air in moisturizing experiment while both surfaces were kept in free air during drying experiments. Experiments were performed in a chamber with controllable atmosphere and temperature. Device details are presented. Results of water diffusion for temperatures in the range from 25oC up to 35oC in moisturizing and drying regime are presented.
Thermal conductivity sensor is based on hot-ball method for measuring thermal conductivity. A ball delivers constant heat into surrounding material in a step-wise regime. Simultaneously temperature of the hot ball is recorded. Thermal conductivity is calculated from this temperature record. Measuring principle and experimental details of the method are presented.