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Surface roughness change on sandstone induced by temperature increase

J. Vlcko (1), Z. Kompanikova (1), M. Gomez-Heras (2), V. Greif (1), T. Durmekova (1), and M. Brcek (1)
(1) Comenius University, Engineering Geology, Bratislava, Slovakia, (2) Universidad Complutense Madrid, Spain

Optical surface profilometer allows capturing the information necessary to provide 3D surface measurements in a single image acquisition with a vertical micrometric resolution. The surface topography can be used for analyses, such as roughness evaluation. In this research, roughness changes of two types of sandstone samples were studied before and after heating to 60, 200, 400, 600 and 800 °C. Measurements obtained were converted into 3D 5 mm x 5 mm (25 mm2) topographic maps with a resolution of 2.5 μm. Surface roughness parameter Sq represents quantifies roughness from the maximum deviation along a mean surface and it is calculated as the root mean squared of five peaks and valleys of the specimen using Gaussian filter and 0.80 mm cut-off. The high spatial resolution obtained from visible-light optical surface profilometer is an ideal tool for observing rock surface alterations caused by decay factors. The authors present complete original process of surface roughness determination on rock samples adopting the portable profilometer using free accessible software packages.
The different stability of the fabric of sandstones from Králiky and Oravská Jasenica after heating is due to their different mineral composition and different ratio of minerals that are more or less chemically stable at high temperatures, their resistance to thermal stress and other textural factors related to the distribution of grains and matrix. Percentage of minerals chemically stable at higher temperature, such as quartz, calcite, illite and muscovite, in fresh sandstone samples from Králiky is approximately 48%. Conversely, sandstones from Oravská Jasenica have significantly greater percentage of minerals stable at higher temperatures, such as quartz, albite, orthoclase, muscovite, illite and calcite than of other, less stable, minerals such as chlorite, biotite and kaolinite. Hence, percentage of minerals stable at higher temperatures was approximately 81 %. The results show how the ratio of stable and less stable mineral phases is an important factor affecting the resistance of rocks to high temperatures and are reflected in optical surface roughness parameters, which increase with increasing temperature.
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