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Cement Bond Characteristics of Artificially Fabricated Sandstones

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Abstract : The synthetic rocks have been advantageous over the natural rocks in terms of availability and the consistent studying the impact of a particular parameter. The artificial rocks can be fabricated using variety of techniques such as mixing sand and Portland cement or gypsum, firing the mixture of sand and fine powder of borosilicate glass or by in-situ precipitation of calcite solution. In this study, sodium silicate solution has been used as the cementing agent for the quartz sand. The molded soft cylindrical sandstone samples are placed in the gas-tight pressure vessel, where the hardening of the material takes place as the chemical reaction between carbon dioxide and the silicate solution progresses. The vessel allows uniform disperse of carbon dioxide and control over the ambient gas pressure. Current paper shows how the bonding material is initially distributed in the intergranular space and the surface of the sand particles by the usage of Electron Microscopy and the Energy Dispersive Spectroscopy. During the study, the strength of the cement bond as a function of temperature is observed. The impact of cementing agent dosage on the micro and macro characteristics of the sandstone is investigated. The analysis of the cement bond at micro level helps to trace the changes to particles bonding damage after a potential yielding. Shearing behavior and compressional response have been examined resulting in the estimation of the shearing resistance and cohesion force of the sandstone. These are considered to be main input values to the mathematical prediction models of sand production from weak clastic oil reservoir formations.

Keywords : artificial sanstone, cement bond, microstructure, SEM, triaxial shearing
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