EFFECT OF TEMPERATURE ON THE THERMAL DIFFUSIVITY AND HEAT CAPACITY OF SANDSTONE

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The well-known contact-free, laser Flash method was used for measurement of the thermal diffusivity (a) of natural sandstone samples. The experimental procedure was conducted using the micro Flash apparatus ($LFA457$). The measurements have been made over the temperature range from (302.9 to 774.3)K. The isobaric heat capacities (CP) of the same sample were measured over the temperature range from (308 to 763)K using DSC 204 $F1$. Uncertainties of the thermal diffusivity and heat capacity measurements are 3% and 1%, respectively. Measured values of a and CP together with density data were used to calculate the thermal conductivity of sandstone. Theoretically based correlations for the thermal diffusivity (damped harmonic oscillator, DHO) and heat capacity (Debye and Einstein) theories were adopted to accurately represent the measured data. Correlation equations for the thermal diffusivity and heat capacity have been developed using the well-known theoretical asymptotic behavior of a and CP(T) for various temperature ranges (low- and high-temperature limits). The microscopic nature of the effect of temperature on a(T) and $\lambda(T)$ behavior of sandstone is discussed. Detailed interpretation and testing of the measured property data for sandstone using various existing theoretical and empirical models, in order to check their accuracy, predictive capability, and applicability, were provided.