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A measurement method and system of the thermal properties of rocks under high pressure without heat source

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Thermal properties of rocks under high pressure are very important for us to understand the thermal structure and state of earth. Basing on the classical thermo-elastic theory, we can know that the temperature of an elastic substance will change when it is compressed or stretched under adiabatic condition. Our measurement results show that the adiabatic stress derivative of temperature (dT/dP) of rocks ranges from 1 to 6 mK/MPa. But the result of silicone oil is up to about 140 mK/MPa. So, we developed a measurement method and system of the thermal properties of rocks under high pressure. In the hydrostatic compression system, the confining pressure can rapidly increase to high pressure within 1∼2 s by controlling the value. By monitoring the temperature changes in center and on surface of rock sample during the rapidly loading process, the thermal properties, including thermal conductivity, thermal diffusivity and volumetric heat capacity, can be resolved by our finite element numerical inversion method. We measured several representative rocks from Longmenshan Fault Zone and Chelungpu Fault Zone (TCDP Hole-A), such as sandstone, siltstone, limestone, granite, basalt, tuff and so on. The results indicate that this method and system is suitable for thermal properties measurement under high pressure even though there is without heat source.