CALIBRATING TROILITE COSMOTHERMOMETER IN BRAUNSCHWEIG METEORITE.

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Introduction: Differential scanning calorimetry is a convenient technique to measure α/β phase transformation in troilite of meteorites. The aim of the paper was to determine the effect of the maximum temperature of controlled, laboratory heating and time of heating on the temperature of α/β phase transformation in Braunschweig troilite.

Methods: Temperature of α/β phase transformation in 10-20 mg crushed samples of the Braunschweig L6 chondrite containing 2.1-7.8 wt% of troilite were measured by a differential scanning calorimeter Q200 (TA Instruments, USA) at heating rate of 20 ^{o}C/min under nitrogen. α/β phase transformation in troilite was evaluated after each sequence of heating/cooling without removal of the sample from the DSC instrument. Samples were heated to various maximum temperatures between 170 and 600 ^{o}C, maintained over 0.1, 2, 5, or 10 min at each maximum temperature then cooled down, measured and reheated to the subsequent, higher maximum temperature.

Results: Maximum temperature of heat treatment and period of heat treatment at maximum temperature affect temperature of α/β phase transformation in troilite. The temperature of α/β transition (offset and peak T_{peak} temperature) shows gradual decline with the increase in the maximum temperature of preceding heat treatment. The peaks become broader and the heat enthalpy of the transition decreases with increasing heat treatment temperature, which is in accordance with the previous reports for L chondrites [1-5]. Temperature of α/β phase transformation in Braunschweig troilite varies inversely with the maximum temperature of the heat treatment. For example: starting with T_{peak} = 149.7 ^{o}C for the virgin, untreated sample 1, after its subsequent isothermal annealing for 0.1 min it was obtained in subsequent runs: 149.0 ^{o}C (annealing at 170° C), 148.6 ^{o}C (at 200 ^{o}C), 146.6 ^{o}C (at 250 ^{o}C), 146.3 ^{o}C (at 300 ^{o}C), 145.6 ^{o}C (at 400 ^{o}C), 145.0 ^{o}C (at 500 ^{o}C), and 145.1 ^{o}C (at 600 ^{o}C). Sample 2 annealed for 10 min in each run revealed: untreated sample peak position T_{peak} = 149.4 ^{o}C, 148.1 ^{o}C (at 170 ^{o}C), 146.7 ^{o}C (at 200 ^{o}C), 145.8 ^{o}C (at 250 ^{o}C), 143.9 ^{o}C (at 300 ^{o}C), 141.1 ^{o}C (at 400 ^{o}C), 139.0 ^{o}C (at 500 ^{o}C), and 139.0 ^{o}C (at 600 ^{o}C).

Conclusions: Annealing temperature and time are crucial parameters in troilite thermometry. Relict temperatures between 160 and 600 ^{o}C can be determined by troilite thermometry. Braunschweig's interior reveals relict temperature about 435 K.

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