MEAN ATOMIC WEIGHT AND THERMOPHYSICAL PROPERTIES OF SARIÇIÇEK HOWARDITE.

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Introduction: Mean atomic weight and thermophysical properties are important to characterize minerals, rocks, planets, moons and asteroids, and are important to classify meteorites. Recenty interrelationships between mean atomic weight *(Amean)*, grain density, and iron to silicon ratio for planetary materials were revealed and applied for predicting and verifying mean atomic weight, *Fe/Si* atomic ratio, and grain density of ordinary and enstatite chondrites, Earth, Venus, Mars, Mercury, Moon, and Vesta [1-5]. The aim of the paper was to determine mean atomic weight and to predict heat capacity, thermal conductivity, and thermal diffusivity of Sariçiçek howardite. Sariçiçek meteorite fell on September 2, 2015 in Turkey, and have been classified as an eucrite-rich howardite [6].

Literature data on chemical composition of Sariçiçek howardite [6] and composition of various HED meteorites [7] were used to calculate *Amean* and *Fe/Si* values and to establish *Amean(Fe/Si)* relationship for howardites. Relationship between specific heat and bulk density (*Cp(dbulk*) [8] was used to predict specific heat capacity, and relationship between thermal conductivity and porosity (*K(porosity)* [9] was used to predict *K* values.

Results and discussion: Collected data indicate that there exists empirical *Amean(Fe/Si) d*ependence describing howardite matter expressed by the equation:

$$Amean(Fe/Si) = 7.67 \cdot Fe/Si + 20.08, \qquad (1)$$

for which $R^2 = 0.74$, and RMSE = 0.14. Iron to silicon atomic ratio for the Sariçiçek *Fe/Si* = 0.30 ± 0.01 is close to the mean value of *Fe/Si* for howardites (0.33, range: 0.26-0.39). Equation (1) predicts for Sariçiçek *Amean(Fe/Si)* = 22.37 ± 0.14 ≈ 22.4 ± 0.1, and predicts the average value for howardites *Amean(Fe/Si)Howardites* = 22.61 ± 0.14 ≈ 22.6 ± 0.1. Equation (1) predicts for Frankfort (stone) howardite *Amean(Fe/Si)* value: 22.22 ± 0.14 ≈ 22.2 ± 0.1 (*Fe/Si* = 0.28), and bulk composition of this howardite reveals the value: *Amean* = 22.2 [7].

Bulk elemental composition [6] leads to *Amean* = 22.56 ± 0.13 ≈ 22.6 ± 0.1 for the Sariçiçek meteorite, and bulk elemental composition of seventy howardites [7] to the average value of *Amean* = 22.4 ± 0.2, and to the *Amean* range: 22.0 - 22.8 [7] for most howardites. Diogenites bulk composition reveals *Amean* range: 21.4-22.3, and average *Amean* = 21.8, and eucrites bulk composition reveals *Amean* range: 22.1-23.3, and average *Amean* = 22.7 [7]. Average *Amean* values follow the inequality:

$$AmeanDiogenites(21.8) < AmeanHowardites(22.4) < AmeanSariçiçek(22.6) < AmeanEucrites(22.7). \qquad (2)$$

Presented data confirm classification of Sariçiçek as an eucrite-rich howardite [6]. These new *Amean* data for HED meteorites and protoplanet Vesta indicate that: *AmeanHEDs(21.8-22.7)* < *AmeanVESTA(24.2* [2]), which supports the presence and contribution of metallic core to the global mean atomic weight of Vesta [2].

Cp(dbulk) dependence [8] leads to the value of specific heat capacity of Sariçiçek: *Cp* = 756 J(/kg·K) at room temperature (300 K) (*dbulk* = 2.91 g/cm^3 [6]). The volumetric heat capacity of Sariçiçek *Cvolumetric* = $2.2 \cdot 10^6$ J/(m^3·K) at RT, and is close to RT value characteristic of stony meteorites: $2.5 \cdot 10^6$ J/(m^3·K) [8]. Mean atomic heat (*Amean·Cp*) of Sariçiçek is: 17.0±0.2 kJ/(mol·K) at room temperature.

Thermal conductivity of Sariçiçek predicted by *K(Porosity)* dependence [9] (*P* = 9.4±0.9% [6]) is equal to: 1.1±0.2 W m^{-1} K^{-1} at 200 K, and estimated by *K(T)* dependence: 1.3±0.2 W m^{-1}K^{-1} at 300 K. For comparison: thermal conductivity measured for Frankfort (stone) howardite: 1.3 W m^{-1}K^{-1} at 200 K, and 1.6 W m^{-1}K^{-1} at 300 K [10]. Thermal diffusivity of Sariçiçek predicted by *D(Cp,K,dbulk)* dependence is $0.6 \pm 0.2 \cdot 10^{-6}$ m^2/s at 300 K, and $0.8 \pm 0.2 \cdot 10^{-6}$ m^2/s at 200 K.

Conclusion: Mean atomic weight of Sariçiçek meteorite confirms its classification as an eucrite-rich howardite.

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