THE IMPACT MECHANICAL TESTS OF METEORITES

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Introduction: It is very little known about mechanical properties of meteorites while its chemistry and mineralogy have been studied extensively [1, 2]. Majority of strength data were obtained from compressive tests while only a few data were performed with tensile tests [1, 3]. Meteoroids were dynamic loaded during interaction with atmosphere and mutual impact action. In this work we present the first numerical results of evaluation of both meteoritic materials and ice impact strength.

Experimental: Dynamic tests of meteoritic materials and ice were performed using instrumented Tinius Olsen IT542 impact test machine at 300 and 77 K. Samples were prepared from monocrystalline and polycrystalline fragments of octahedrite Sikhote-Alin, impact-reheated meteorite Dronino, ataxite Chinga, chondrite Tsarev and ice. Scanning electron microscopes JEOL JSM-66490LV and TESCAN VEGA were used for fracture surface analyses of studied materials.

Results and Discussion: The values of impact strength and ratio of energy of crack propagation (A_p) and crack initiation (A_i) are shown in Table 1. The highest values of impact strength and maximum of A_p/A_i ratio were obtained for Chinga and Dronino iron meteorites which had submicroscopical ($\alpha+\alpha_2+\gamma$) and duplex ($\alpha+\alpha_2$) structures, respectively. Decreasing of the test temperature down to 77 K led to decrease of impact strength values down to 47 kJ/m^2 for Dronino and 1170 kJ/m^2 Chinga. Monocrystalline Sikhote Alin meteorite samples demonstrated brittle transcrystalline fracture surface mode while polycrystalline Sikhote Alin samples were characterized by intercrystalline fracture mechanism. In this case fracture energy was less than for Tsarev chondrite.

Table 1. The impact tests results of meteorites

Meteorite fragment	**KCU, kJ/m^2**	**A_p/A_i**
Sikhote Alin IIAB, mono No 1	103	0.67
Sikhote Alin IIAB, mono No 2	137	0.84
Dronino Iron-ung	2070	0.84
Chinga IVB-an	2210	0.79
Tsarev L5	5.7	0.50
Ice	3.4	0.05

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