

SENSOR METEOR

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During the flight, the spacecraft (SC) is exposed to streams of dust particles. The following effects are observed under the particles exposure on materials and structural elements: surface erosion, particles appearing from own outer atmosphere (OOA), spacecraft surface contamination by the precipitating products of OOA, increasing light background in the vicinity of SC due to the scattering of light by particles OOA and luminescence, the increase in leakage current in open high-voltage devices and decline in their electric strength [1].

Recently, there has been a trend of increasing concentrations of man-made high-speed dust particles in Earth orbits [1-3]. Given all the increasing demands on the reliability and durability of the spacecraft, as well as the emergence of many new materials, further development of research into the processes of interaction of dust particles with high material elements of spacecraft design is essential [3-4]. To determine the parameters of micrometeoroids and space debris we need sensors that convert shock impact into electrical signals.

On the basis of articles and reviews describing experiments with high particle detectors of various designs in laboratory and field conditions, theoretical studies of physical phenomena underlying the transducers, all physical phenomena used in instrumental methods of measurement can be classified as follows: physical phenomena associated with the presence of mechanical motion of the object of research; physical phenomena associated with the properties of the object as a material particle research environment; physical phenomena associated with the properties of the electric charge in the object of study.

Methods and apparatus for recording dust particles can be classified as follows: according to the method of particle interaction with the device methods are divided into contact and contactless; converters are characterized by having one informative output dependence or more; methods for speed and duration of the registration device differ according to generating output pulse signals.

In practice, ionization method is the most sensitive to the effects of micro-meteoroid.

In 2013, two small SCs "AIST" were launched into the Earth's orbit [5]. Each small SC AIST was fitted with scientific instruments METEOR, representing six multi-parameter sensors whose primary purpose is to record high-velocity micro-particles in near-Earth space.

Each of the multi-parameter sensors METEOR has a temperature sensor, an ion gauge of high-speed dust particles, a solar sensor and electrification sensor.

As a result of the METEOR equipment operation within the specified time, several events were recorded, about 15 of which can be classified as high-velocity micro-particles impact.

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References

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