Space Vehicles for Exploration & Propulsion for Deep Space (3)
Space Vehicles for Exploration & Propulsion for Deep Space - Session 2 (2)

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STUDY OF THIN-FILM COATINGS FOR DEEP SPACE TELESCOPE MIRROR DEGRADATION

Abstract

Mirrors with thin-film coatings are used in extraterrestrial telescopes for studying outer space. During operation, mirrors are subjects to destruction from various factors including high-energy photons influence.

Before using the mirror in space, it is necessary to conduct ground tests of the mirrors' resistance to high-energy photons. It is possible using a magnetoplasma compressor. Magnetoplasma compressor is a source of broadband high-brightness radiation that allows one to simulate bright radiation in outer space.

Ground tests include irradiation with a magnetoplasma compressor and post-processing: measurements on spectrophotometer (loss of reflectivity), optical microscope (presence/development of cracks on the sample), atomic force microscope (roughness). Due to the quasi-spherical nature of the radiation source, it is possible to study mirrors degradation from the radiation power density. It depends on the distance to the radiation source.

Such studies were conducted for mirrors with aluminum / magnesium fluoride and molybdenum / silicon coatings. As part of experiment the short-wave spectrum boundary was changed by using different buffer gases and the radiation power density was changed by reducing the distance to radiation source. The results are discussed.

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