
SPACE RADIATION EFFECTS ON MATERIALS



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SPACE RADIATION EFFECTS ON MATERIALS

Sponsored by
ASTM COMMITTEE E-10
ON
RADIOISOTOPES AND RADIATION EFFECTS



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P R E F A C E

Under the auspices of ASTM Committee E-10 on Radioisotopes and Radiation Effects, a special study group was established early in 1961. The purpose of the group was to examine the state of knowledge of space radiation and the effects of such radiation on materials. The group was to prepare a working document which would summarize the findings, point out problem areas, and indicate directions for research and further ASTM activities.

The study is specifically limited to the naturally occurring (indigenous) radiation of space and does not include the effects of weapons bursts or the radiations from a nuclear engine. It does introduce the important considerations of temperature and vacuum with which materials in space must contend.

In a field where new investigations may result in changes in reference data from one day to the next, no survey can be taken as final. It is hoped that this report, although dated, may provide an introduction to the subject matter and serve as a basis for planning. For the most up-to-date values of parameters, the current literature must be consulted.

Part I of this report deals with the space environment; Part II, radiations present in space near the earth, their sources, and characteristics. Part III summarizes the effect of radiation on various types of materials and includes some general discussion of the damage mechanisms involved. The next sections deal with methods of investigation and sources of information. Finally there are conclusions and recommendations.

The study group has recommended that ASTM should provide a platform for exchange of ideas, improvement of research techniques, and suggestions for the most fruitful avenues of further research. Long before the writing of standards can begin, the committee structure could become useful.

As new techniques are developed, use can be made of existing standards for calibration and correlation. As new methods are devised and evaluated the industry can more easily settle on successful techniques and use these as the bases for standard procedures. It may not be clear at present just where standardization is needed in the study of space radiation effects. But it is likely that the need will arise to specify methods of reporting data, measurement of dose levels and exposures, test specimens, materials, and interpretation of results.

General Chairman of this study was Robert S. Shane of the Light Military Electronics Department of the General Electric Co. at Utica, N. Y. The members of the Study Group met first on Jan. 11, 1961, in Utica, N. Y. to determine the scope of the study, form a working organization, and assign responsibilities. Drafts of sections of the report were prepared for

discussion at the second meeting, which was held at The International Nickel Co. on May 11, 1961. R. S. Shane assembled the drafts and prepared the manuscript. At the request of Committee E-10 on Radioisotopes and Radiation Effects, W. Kermit Anderson of Knolls Atomic Power Laboratory, Schenectady, N. Y., edited the preliminary manuscript and prepared draft copies which were furnished to members of the original Study Group in January 1962 for their review.

Comments of the Study Group members have been incorporated, and various sections were brought up to date. Lowell K. Zoller, NASA, Marshall Space Flight Center, Huntsville, Ala., prepared the sections on the space environment and space radiation. The discussion on trapped radiation and Appendix I was supplied by Haven E. Bergeson, General Electric Co.-MSVD, Philadelphia, Pa. The final report was edited by A. David Rossin of Argonne National Laboratory, Argonne, Ill.

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Robert S. Shane, *Chairman*
Special Study Group on Space Radiation
and Matter
ASTM Committee E-10 on Radioisotopes
and Radiation Effects

Utica, N. Y.
September 19, 1962

NOTE.—The Society is not responsible, as a body, for the statements
and opinions advanced in this publication.

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THIS PUBLICATION is one of many issued by the American Society for Testing and Materials in connection with its work of promoting knowledge of the properties of materials and developing standard specifications and tests for materials. Much of the data result from the voluntary contributions of many of the country's leading technical authorities from industry, scientific agencies, and government.

Over the years the Society has published many technical symposiums, reports, and special books. These may consist of a series of technical papers, reports by the ASTM technical committees, or compilations of data developed in special Society groups with many organizations cooperating. A list of ASTM publications and information on the work of the Society will be furnished on request.

