SOME ASPECTS OF THE DEGRADATION OF FEP TEFLON MATERIAL UNDER THE ACTION OF VUV, THE SUN AND GROUND TEST VUV FACILITIES

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1.0 Introduction

FEP Teflon® is widely used as a thermal blanket material in space applications. There is growing evidence, however, of the degradation of FEP Teflon during space flights. From recent publications [1, 2] it can be concluded that soft X-ray radiation from solar flares is one of the main factors influencing this degradation. There are also many ground-based experiments where the degradation of FEP under exposure to VUV-sources has been observed [3-7].

At the same time, in VUV-tests with the Hamamatsu L879 VUV lamp, no mechanical degradation was observed after 24 hours of ground testing [1]. The sample was maintained under a constant purge of dry nitrogen to avoid contamination of the VUV-lamp window and to eliminate the presence of any amount of oxygen. The behaviour of such exposed FEP samples was identical to the virgin sample as shown by mechanical testing.

The film surface however was eroded. Initially, no attention was paid to this fact because etching is a common feature during VUV-tests.

Radiation, such as VUV-radiation in the reaction with materials, partially reflects and is partially absorbed by the material. The absorbed radiation energy is then partly spent on irreversible chemical reaction and emissivity; the main part of the absorbed energy is, however, transformed into heat. This heating process during irradiation is not something newly reported [8], but this paper will deal with the investigation and consideration of the heat output during VUV-radiation tests. Some details of calculations and concerns about accelerated VUV-tests interpretations are presented.
2.0 Calculation of the heating of FEP Teflon material under sun illumination

Figures 1a and 1b present the sun irradiation spectrum. The ranges of VUV and IR are presented in Table 1 and Table 2.

Figure 1a

Sun Irradiation spectra between 0 and 2 μm

Figure 1b

Sun Irradiation spectra between 0.1 and 100 μm