

Effects of space environment

Vacuum exposure does not affect inorganic glasses or most organic glasses. The main danger comes from bonding agents, optical coupling agents and other assembly materials which can contaminate the optics by yielding condensable products. A contaminated optic is, in general, very difficult to clean.

Radiation is the most harmful factor to be considered for glasses. Some inorganic glasses are damaged by doses of the order of 10 Gray of ionizing radiation (1 Gray = 1 J kg⁻¹ of absorbed energy): the damage is a loss of transparency in certain wavelength ranges due to colour-centre formation. UV is less harmful, at least for inorganic glasses. Particle radiation can also distort the shape of optical elements. Plastics can be damaged by particle and UV radiation. The result is, in general, a “yellowing”, and the damage under sunlight can be auto-accelerated by the increase in temperature due to higher absorption.

Temperature: Thermal shock can lead to fracture in inorganic glasses. Also, distortion can be noted in precision optics when the assembly is not designed to compensate correctly for the low expansion of these glasses and the high expansion of metal mountings. Organic glasses soften at quite low temperature (80 °C to 100 °C frequently) and have rather high expansion coefficients.

Atomic oxygen can attack organic glasses.