Recovery of flight hardware from the Solar Maximum Mission Spacecraft, after long exposure to Low Earth Orbit (LEO) environment, revealed more degradation of external spacecraft materials than had been expected. Similar degradation was observed on subsequent Shuttle flights and other experiments were subsequently flown to investigate this effect on a large variety of materials. The degradation appeared as changes in physical and chemical properties and surface morphology as well as considerable weight loss in some cases.

The effect has been attributed to interactions with atomic oxygen, which is the predominant atmospheric species present in the rarified atmosphere from 200 to 700 km or LEO. It has also been shown that the degradation occurs predominantly on materials exposed to the forward velocity vector of the spacecraft (ram direction). In addition to being orientation dependent, the extent of degradation is directly related to the type of material. Although present knowledge is very limited, the following generalizations are appropriate:

- Carbon is very susceptible to attack.
- Polymers such as Kapton, Mylar, Lexan (polycarbonate) and polyethylene are susceptible to attack.
- Perfluorinated polymers, such as Teflon, appear more stable.
- Silicone polymers appear to be fairly stable.
- The stability of filled polymers is related to the characteristics of the filler.
- Metals appear to be stable (except for osmium, silver and possibly copper).
- Metal oxides (Al_2O_3, SiO_2, etc) that are used for thermal control appear to be stable.
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When considering materials for exposed surfaces in LEO, this degradation phenomenon cannot be ignored.