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ANALYSIS OF THRUSTER PLUME CONTAMINATION DURING SPACECRAFT SEPARATION

Abstract

The potential plume contamination mainly consists of two parts, the gas-phase molecular contamination and liquid-phase contamination. It was reported that plume induced contamination for typical International Space Station (ISS) sensitive surfaces, which were in the 230 - 300K range, was dominated by the liquid-phase for the gas would not condense on the warm surfaces. The impingement of reaction control system (RCS) engine plume may induce contamination problem to the optical surfaces, especially to the sensitive devices of proximity operation during the berthing or docking and separation mission. Degradation in performance of the optical system such as lenses, view ports, reflective surfaces will result in compromises of mission effectiveness. This study which employed the plume contamination model of ISS predicted the mass of liquid-phase contamination deposition in the spacecraft separation mission, and analyzed the optical system performance degradation in the mission. The analysis result shows that a little decrease, less than 1%, was induced to optical lens transmittance in this separation mission, and causes little effect to the spacecraft optical system. The transmittance decrease caused by three or four times of this mission can also be accepted. Therefore, the space contamination environment induced by thruster plume in separation mission doesn't do great harm to the spacecraft. Methods of this study could be compatible with the proximity example which was the converse progress of separation.