ABSTRACT

Use of adhesive bonding for space applications brings advantages such as flexibility, joining of dissimilar materials and mass savings, but it is also a common source of failures. The root causes of these failures are often attributed not only to performance losses due to exposure to simulated space environment during testing phases, but also due to inefficiency of surface treatments of the substrates prior to bonding, improper curing process and exposure of manufactured joints to ambient atmosphere during the entire on-ground life cycle.

In particular, adhesive bonding is frequently used in design of optical instruments and may represent significant challenge for the manufacturers. Such bonding must be able to withstand the harsh environmental conditions, such as enhanced humidity, thermal cycling between two temperature extremes, long term thermal exposures in vacuum, the impact of vibrations and shocks during the launch phase, all without any significant drop in performance of bonded optical assembly and with retainment of alignment / dimensional stability.

The surface preparation and curing regimes belong to the key steps for success in this case and are currently under investigation in ESA/ESTEC in collaboration with external partners. A general overview of the adhesive bonding for space applications and its criticalities in this context will be presented in this work, focusing in particular on the importance of surface treatment.