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Space Structures II Development and Verification (Orbital deployable and dimensionally stable structures, including mechanical and robotic systems and subsystems) (2)

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ACTIVELY CONTROLLED DEPLOYABLE POLYMER REFLECTORS FOR SMALL SATELLITE APPLICATIONS

Abstract

The presentation will report on the Advanced Multilayer Adaptive Thin Shell (AMATS) project aimed at developing actively controlled deployable primary reflectors with collecting area significantly larger than the size of the satellite. The project, supported by the ESA GSTP program, involves MateriaNova (Mons, Belgium) and Université Libre de Bruxelles (ULB). By utilizing a flexible polymer substrate material with an integrated piezoelectric polymer control layer, the reflector can be folded into a small space while using active control to compensate for thermal, viscoelastic and manufacturing errors.

The targeted applications are in the Long Wave Infrared (LWIR, $\lambda = 10$) which is gaining interest for Earth observation, astronomical applications, and up- and downlink laser satellite communication (because data transmission under adverse weather conditions is possible in LWIR). These applications would benefit enormously from the increase of the reflector size while the surface figure accuracy for LWIR seems to be achievable with active control.

The project builds on a previous demonstration of the control of a spherical thin polymer shell using a piezoelectric polymer (PVDF-TrFE) activated by an array of independent electrodes on the back side of the reflector. In the AMATS project, the design has been improved by the addition of a thermal balancing layer, and the geometry is being adapted to a petal-design suitable for folding into a 3U CubeSat. The presentation will report results on:

1. Recent progress in manufacturing of the petal polymer reflector.
2. The thermal response of the reflector.
3. The recent developments of a metrology system adapted to the in-lab measurements of the surface figure of a petal spherical reflector with large aberrations, an extension of the Software Configurable Optical Testing System (SCOTS) initially developed in the University of Arizona.
4. The numerical simulation of the folding-deployment phases and the estimation of the folding stresses.