

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Smart Materials and Adaptive Structures (5)

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DEVELOPMENT OF NEW SMART MATERIALS FOR LATER BENEFICIALLY APPLICATION IN
CLOSED HABITATS IN LEO AS WELL AS DURING SOLAR SYSTEM EXPLORATION

Abstract

The higher degree of system closure and the absence of easy performing emergency return/ material transport missions are the two main issues, being characteristic in an extraordinary manner for missions of the solar system exploration, but also already for stays in closed habitats in LEO (space shuttle/ ISS).

This leads to the necessity to develop more sustainable materials, especially in the meaning of non-disruptive and non-damaging on the living organism and on equipment (e.g. no release of toxic substances, non-attractive for the growth of destructive life forms as fungi etc.) as well as in the meaning of being Repairable, Refurbishable Replaceable, Reconfigurable, Retrievable, Reusable (acc. to Valerani, 2001). In addition, the development of such technologies will emerge positive effects for the application in the closed biosphere Earth.

Some of the main problems which have to be covered in this context are the development:

- of less toxic but more flexible applicable adhesives (broader spectra of materials to be stick etc.).
- of antimicrobial surfaces to cover existing problems with microorganismic contamination without using harmful chemical based cleaning processes.
- of antifreeze surfaces to cover existing problems inside and outside habitats with icing, currently only to be prevented by harmful chemicals, energy consuming heating and also sometimes not (comp. icing problems space shuttle booster).

Biomimetic strategies are of main interest for such sustainable technologies: Especially the continuous optimisation process during millions of years of evolution enforced effective solutions. Mutations, mainly negative, however, in special cases lead to better adapted organisms after environmental alterations.

First projects are performed currently in interdisciplinary teams together with non-space institutions. Co-fundation is secured by non-space organisations, demonstrating the high relevance for Earth applications.

An overview of the different research activities including their benefits for space exploration and on Earth will be given. The results of the development of a biomimetic adhesive in the frame of the ESA-ITI-project "Alternative Glues in Space and on Earth based on Biomimetic Strategies" (Glue2Space) (ESA-ITI 19585/06/NL/CP) will be presented more intensively, for the development of antifreeze and antimicrobial surfaces results of an application analysis will be given.