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Author: Dr. Laurence Lemelle
CNRS, France, laurence.lemelle@gmail.com

Dr. Christophe Place
CNRS, France, christophe.place@ens-lyon.fr
Mrs. Eleonore Mottin
CNRS, France, eleonore.mottin@ens-lyon.fr
Mr. Denis LeTourneau
CNRS, France, denis.le.tourneau@ens-lyon.fr
Dr. Guillaume Nonglaton
Commissariat à l'énergie atomique et aux énergies alternatives (CEA), France, guillaume.nonglaton@cea.fr
Mr. Pierre Marcoux
Commissariat à l'énergie atomique et aux énergies alternatives (CEA), France, pierre.marcoux@cea.fr
Dr. Jeremie Teisseire
CNRS, France, Jeremie.Teisseire@saint-gobain.com
Mr. Emmanuel Garre
CNRS, France, Emmanuel.Garre@saint-gobain.com
Dr. Lucie Campagnolo
MEDES, France, lucie.campagnolo@cnes.fr
Mrs. Cecile Thevenot
MEDES, France, Cecile.Thevenot@cnes.fr
Dr. Alain Maillet
MEDES - IMPS, France, alain.maillet@cnes.fr
Mr. Sebastien Rouquette
CADMOS-CNES, France, Sebastien.Rouquette@cnes.fr
Mr. Patrice Benarroche
CADMOS-CNES, France, Patrice.Benarroche@cnes.fr
Mr. Sebastien Barde
CADMOS-CNES, France, Sebastien.Barde@cnes.fr

A MATISS-1 OPTICAL SURVEY OF THE PARTICLES CLASSES CONTAMINATING VARIOUS SURFACES IN THE ISS

Abstract

Biocontamination in manned spacecrafts and in future habitats could have significant impacts on crew health and biodegradation of equipment. In particular, there is a need for decreasing the dependency of crew action for cleaning actions. Anti-microbial surfaces that inhibit or reduce the ability of microorganisms to grow on the surfaces are of high interest. In the context of future manned mission scenarios of longer duration, higher isolation and the utilization of an increasing number of closed-loop life support systems, the coating or surface modification must be effective 'in-use'.

The MATISS experiment (Microbial Aerosol Tethering on Innovative Surfaces in the International Space Station) aims to demonstrate that surfaces with hydrophobic properties already implemented in

numerous industrial fields could be a possible answer applicable on the scale of spacecraft. By reducing the contact area of the droplets of water with surfaces, the hydrophobicity allows at the first order to limit the fraction of the surface which is contaminated. It also limits the adhesion of microorganisms to surfaces. In this respect, a spatialized set-up was developed.

A MATISS set-up that protects the glass surfaces while sampling ISS atmosphere was conceived and mounted glass lamella which surfaces were modified to become hydrophobic applying industrializable processes controlled by two RD French groups: the CEA Léti and Saint Gobain. 4 sample holders were exposed 6 months in the Columbus module and returned in their ziplock bags for analyses under confinement in laboratories. PCR was carried out on the biocontaminations sampled on the external surface of the holders. Systematic imaging of the surfaces under confinement was carried out at low and high magnification.

An outcome of the optical survey of the exposed surface is the indexation of 5500 particles (average density <2 particles / mm2). Based on their sizes and shapes, we can distinguish 5 classes of particles: textile fibers (Area>1500μm2), irregular and angular patches (50 μm2<Area<1500 μm2), and very much smaller particles consistent with colonies (4.5 μm2 < Area < 15 μm2) and cocci and rod-shaped particles (0.5 μm2 < Area < 4.5 μm2). The influence of the surface coating on the distribution of each class of particle displays a clear impact of the FDTS coating on the fibers and the smallest particles distributions that will be more systematically investigated from the on-going experiments MATISS-2 and 2.5.