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Author: Mr. Mohamed Makthoum Peer Mohamed
COMEX SA, France

Dr. Małgorzata Hołyńska
ESA, The Netherlands
Dr. Peter Weiss
COMEX SA, France
Mr. Thibaud Gobert
COMEX, France
Mr. Yann Chouard,
COMEX SA, France
Mr. Nisheet Singh
COMEX SA, France
Mr. Theo Chalal
COMEX SA, France
Ms. Nina Sejkora
Austrian Space Forum, Austria
Dr. Gernot Groemer
Austrian Space Forum, Austria
Dr. Sibylle Schmied
Deutsche Institute für Textil - und Faserforschung (DITF), Germany
Mr. Matthias Schweins
Germany
Dr. Thomas Stegmaier
Deutsche Institute für Textil - und Faserforschung (DITF), Germany
Dr. Götz T. Gresser.
Deutsche Institute für Textil - und Faserforschung (DITF), Germany
Dr. Shumit Das
ESA, The Netherlands

PLANETARY EXPLORATION TEXTILES (PEXTEX) - MATERIALS SELECTION FOR SURFACE EVA SUIT DEVELOPMENT

Abstract

New era of human space exploration is about to start: after more than 17years of successful operations on the International Space Station(ISS), ESA and its international partners are working on a return to the Moon with the now starting construction of an orbital “base camp”, Lunar (Deep Space) Gateway, that will serve to perform robotic and human excursions to the surface of the Moon. Operations with astronauts on the lunar surface will be quite similar to those performed in the Apollo Programme of the 1970ies. During Apollo 17mission, after more than 22hours of EVA on the lunar surface in the Taurus-Littrow valley, NASA astronauts Gene Cernan and Harrison Schmitt had troubles moving the arms and legs of their spacesuits due to dust that had jammed the joints of the articulations. When both astronauts

entered the Lunar Module on December 13th, 1972 to return back to Earth, some parts of the suits lacked three layers of the outer skin, abraded by lunar regolith. However, it is to be expected that in the future EVA will last longer and on a more regular basis than those performed by the Apollo astronauts. Future surface EVA on the lunar surface will require improved suit concepts compared to the previous systems, such as the Apollo A7L or their Russian counterparts. Functionalities should include improved flexibility and the use of smarter materials that are able to heal defects or monitor their integrity. These novel functionalities might be addressed by new materials developed recently which, on the other hand, have to be tested versus the harsh environment of space or planetary surfaces. ESA has awarded a study to the PExTex Consortium (DITF and OeWF under the coordination of COMEX SA) to select and test EVA suit outer layer material samples for the development of enhanced EVA suit concepts.

The study is performed in two main tasks:

1) To identify (novel) materials for future EVA space suit developments in Europe, following a detailed literature survey on current and advanced materials in textile industry, which are then cross-examined with different EVA suit material layer requirements and lunar environment conditions to select top candidate materials.

2) To propose a testing strategy to verify that such materials meet the selection criteria conditions along with a dedicated test platform.

This paper presents the top selected candidate materials based on the Consortium's literature survey and provides the outline for the selected testing strategy.