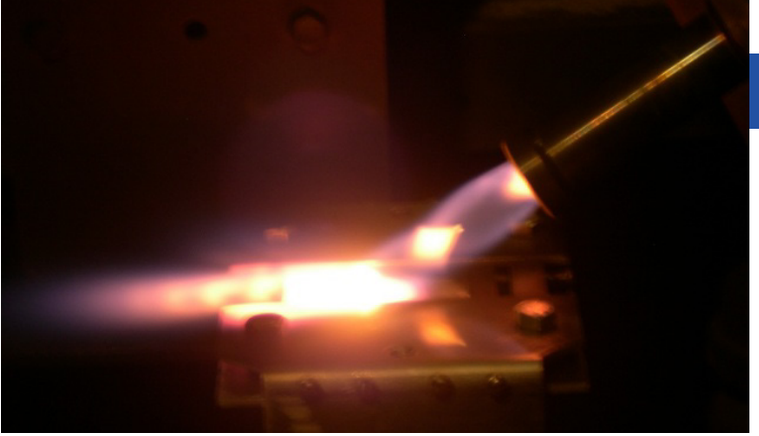


POTENTIAL APPLICATION AREAS

In terms of working temperature limits, durability, cost-effectiveness, weight, maintenance, etc., the LIGHT-TPS results address the requirements of any future space mission to be carried out by RSS. Therefore, the prime application for the project results will be in the field of RSS design. At the same time, the new materials and production technologies developed within the project can be successfully applied in such sectors as energy and transport.

INTERNATIONAL COOPERATION

The project is an excellent example of the international cooperation in science, as it is implemented by a multidisciplinary team composed of representatives of European and Ukrainian research communities. While the European partners bring in the cutting edge expertise in the field of ceramic material science, the Ukrainian colleagues complement it with long-standing excellence in heat-resistant metals and respective production technologies.

CONSORTIUM

Coordinator:
Fundacion Tecnalia Research & Innovation
www.tecnalia.com | maria.parco@tecnalia.com

Frantsevich Institute for Problems of Materials Science of National Academy of Sciences of Ukraine (NASU)
www.materials.kiev.ua

YUZHNOYE Design Office named after Mikhail Yangel
www.yuzhnoye.com

Space Research Institute, NASU and National Space Agency of Ukraine
www.ikd.kiev.ua

Institute of electric welding named after Paton of NASU
www.paton.kiev.ua

National Research Council of Italy - Institute of Science and Technology for Ceramics
www.istec.cnr.it

ECM space technologies GmbH
www.ecm-space.de

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR) - Institute of Structures and Design
www.dlr.de/bt

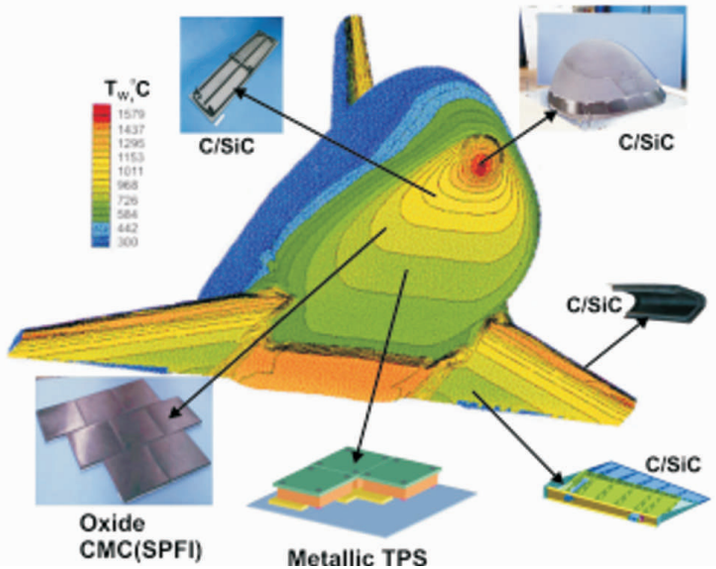
www.light-tps.eu

LIGHT-TPS

EUROPEAN COMMISSION
European Research Area

COOPERATION

SUPER LIGHT-WEIGHT THERMAL PROTECTION SYSTEM FOR SPACE APPLICATION



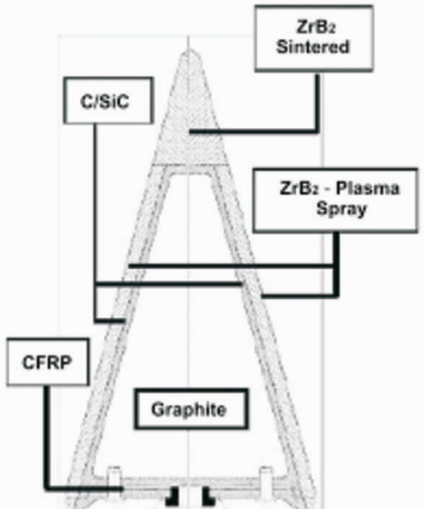
www.light-tps.eu

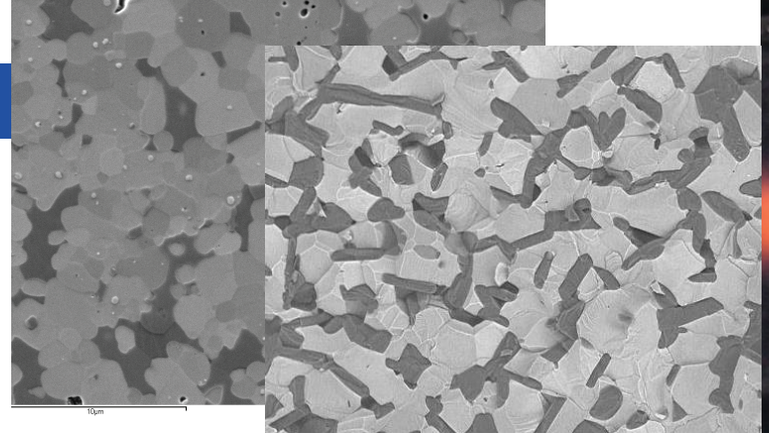
MAIN CHALLENGE

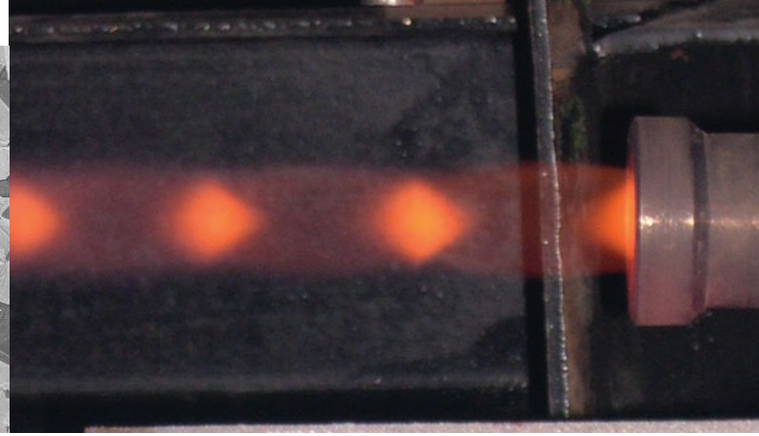
LIGHT-TPS will develop a new super-light corrosion and oxidation resistant complex Thermal Protection System (TPS) for various space applications, above all for Reusable Space Systems (RSS), capable of operating within the entire range of working temperatures.

The works in the project aim at radical improvement the properties of the TPS used in Space Shuttle, Buran, and other existing and under-development RSS.

The basic underlining idea of the project is to combine principle advantages of new metallic and ceramic materials in a single thermal protection system by integrating metallic TPS with non-metallic materials (for example, C/SiC and C/C) and construction elements made of Ultra-High Temperature Ceramics (UHTC) of ZrB_2-SiC-system and heat resistant alloys, coated by composites on the basis of UHTC.







EXPECTED RESULTS OF LIGHT-TPS

The main outcome of the project will be the realistic prototypes of the TPS elements incorporating new materials, technologies and processes.

It will be achieved by obtaining the following:

- The New Ni-Cr alloys with density of 7.5 g/cm^3 obtained by reaction sintering process and having high technological properties due to a fine grain structure. Applying a similar approach, we plan to develop the Niobium alloys with a density less than 6 g/cm^3.
- The new multilayer UHTC composite coating based on system ZrB_2- SiC / $MoSi_2$ designed for the operation in an oxidizing environment with temperatures up to 2000 °C under conditions of thermo erosion effects caused by the heterogeneous gas stream containing solid and liquid particles.
- New manufacturing and construction processes allowing integrating the new materials into a TPS, which will be lighter than 10 kg/m^2.

SCIENTIFIC OBJECTIVES OF LIGHT-TPS

- To develop scientific fundamentals for new manufacturing processes for alloys production based on the methods for reaction sintering process and the process of homogenization acceleration.
- To carry out a pioneering study on the mechanisms of rolling and welding of honey-comb structures from thin sheets and foils of super heat-resistant alloys.
- For the first time ever to investigate the mechanisms of secondary structures formation on the surface of UHTC structures during the operation.
- To optimize the technology for the production of composite ceramic materials with microstructural features typical for plasma sprayed coatings, thermo-mechanical characterization of the ceramics with such tailored morphology and oxidation resistance, thus achieving breakthrough properties.
- To develop the technology for deposing the most suitable UHTC compositions based on the ZrB_2-SiC/$MoSi_2$ system on metallic (Ni-Cr, Nb alloy) and non-metallic (C/C, C/SiC, UHTCMC) substrates of the TPS.