

Enabling extreme temperature performance with functionally graded metal-ceramic material solutions

Stockholm, Sweden, March 2023 – QuesTek Europe is collaborating with University of Extremadura (Spain), University West (Sweden) and Promes CNRS (France) in the M-Era.net project Additive Manufacturing of Actively Cooled Thermal Shields (AM-ACTS).

Growing demands for re-use or extended life span of components at successively increasing working temperatures, are necessitating the development of innovative material solutions in a variety of industrial sectors. Ultra-high temperature materials are in high demand for extreme applications such as space re-entry, hypersonic flight, and high-temperature energy generation in order to achieve sustainability goals and minimize costs. Ultra-high temperature ceramics (UHTC) satisfy the thermal stability requirements, however they are difficult to manufacture and combine with other structural components.

QuesTek Europe is computationally designing functionally graded metal-ceramic (FGMC) multi material solutions for additive manufacturing as part of the AM-ACTS project. A use-case for FGMCs is being developed in the project: actively cooled thermal shields to replace conventional ceramic and metallic heat shields for space re-entry. Utilizing QuesTek's Materials by Design® methodology, we take advantage of the AM-process inherent layer-by-layer deposition to ensure chemical and thermo-mechanical integrity of the material. The collaboration with University West enables simultaneous design of FGMCs structures, and development of their corresponding direct-energy deposition process parameters for accelerated material and component development.

QuesTek's computationally designed functionally-graded metal-ceramic material solutions (QT-FGMCs) are envisioned to solve multiple industrial challenges relating to conventional joining of ceramics to metal structures. Additionally, they have the potential to enhance the extreme temperature resistance of current industrial alloys by facilitating the application of ultra-high temperature ceramics as coatings. This has the potential to revolutionize the market by enabling the use of ceramics in previously challenging environments and extending the capabilities of current industrial alloys which could result in significant improvements in efficiency, durability, and safety across a range of industries.



Image: AM-ACTS project group photo at University of Extremadura in Badajoz, Spain (February 2023).

Contact: David Linder (QuesTek Europe AB), david.linder@questekeurope.com.



About QuesTek Europe AB

QuesTek is a global leader in Materials Design and Integrated Computational Materials Engineering (ICME). Founded in 2016 as a corporate joint venture between QuesTek International LLC and Thermo-Calc Software AB, QuesTek Europe brings together QuesTek USA's Materials by Design™ expertise with the computational software development expertise of Thermo-Calc Software. By doing this, QuesTek Europe is able to offer ICME technologies and modelling services, as well as designed novel materials, to the European market. For more information about QuesTek Europe, visit www.questekeurope.com or contact info@questekeurope.com.