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Poster 3DCERAM : **Use of ceramic materials from additive manufacturing processes in space applications**

Summary :

This poster presents two lines of research on the use of ceramic materials manufactured by 3D printing for space applications, involving CNES, Thales Alenia Space, 3D Ceram and the C2N laboratory.
The first axis concerns terrestrial observation instruments. Thales Alenia Space has been using ceramics (silicon carbide, silicon nitride) for several years for their stability, thermal conductivity and mechanical strength properties, which improves the optical performance of satellites.
The advantage of ceramic additive manufacturing lies in the reduction of production times, the optimization of raw materials and the freedom of design (topological optimization), compared to conventional processes.
After three research projects conducted between 2016 and 2025, significant results have been obtained on silicon nitride (Si_3N_4): conformal microstructure, dense material, Young's modulus of 310 GPa, mechanical strength of 650 MPa and a Weibull coefficient of 12.4.
The next steps are industrial qualification: processing of dispersions related to vertical printing, consolidation of properties over several batches, development of post-sintering finishes and manufacture of structural components according to aerospace specifications.
The second axis concerns the thrusters of New Space satellites. The C2N laboratory, in collaboration with 3DCeram, develops 3D printed ceramic thrusters, exploiting their properties: exceptional thermal resistance, electrical insulation, plasma erosion resistance and compatibility with the vacuum of space.
3DCeram's SLA technology allows a ceramic slip to be light-cured layer by layer, producing dense and precise parts with complex geometries. The first results are considered very promising and pave the way for a real technological breakthrough in space propulsion.