Contribution ID: **71** Type: **3. Oral presentation**

# Ultra-rapid, Pressureless, and Optically Instrumented Manufacturing of High-Performance Ceramics

A novel Pressureless Ultra-Fast Sintering (PLUFS) method has been developed through the integration of a dedicated tooling into Spark Plasma Sintering (SPS) systems. This approach enables heating rates up to 200 ℃/s and reaching 3000 ℃, allowing full ceramic densification to be achieved within seconds under pressureless conditions. PLUFS has been used to demonstrate high efficiency in producing dense ceramic materials while significantly limiting grain growth through optimized thermal profiles. Compared to conventional SPS, PLUFS achieves equivalent densification with approximately five-fold lower energy consumption, highlighting its potential for energy-efficient manufacturing. The method has been applied to a broad range of advanced ceramics, including refractory and structural materials. Real-time shrinkage evolution is monitored using in situ optical dilatometry, providing precise control over the sintering process and an optimization strategy based on PLUFS thermal control enables the identification of non-linear heating schedules that minimize grain growth while maintaining full densification.

## Professional Status of the Speaker

Senior Scientist

## Interest in submitting a paper in a special issue of

Journal of the European Ceramic Society (Elsevier)

## Invitation letter for visa

No

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**Session Classification:** Ultra-fast High Temperature Sintering UHS

**Track Classification:** Group 3: Ultra-fast High Temperature Sintering UHS