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***RF Induction Thermal Plasma: From Materials Synthesis to Surface Engineering***

**Abstract:**

Radio-frequency (RF) induction plasma is an electrode-free thermal plasma generated by electromagnetic coupling. Its main features are a relatively large plasma volume, low gas velocity, long particle residence time, axial feeding, high purity, and operation under inert, reducing, or oxidizing atmospheres. These features have made RF induction plasma a useful tool for both powder synthesis and coating deposition. The technology was developed over many years at the University of Sherbrooke and later transferred to industry through Tekna.

This talk reviews RF induction plasma technology as a flexible route for materials synthesis and coating processing. The need for such flexibility comes from the increasing complexity of modern functional materials. In conventional thermal spray, a change in composition often requires a new spray-grade powder, which is expensive and not practical for exploratory work or small quantities. Suspension and solution plasma spraying changed this situation by allowing the direct use of particles in suspensions, eventually combined with solutions. This makes it easier to modify composition, introduce several elements, and build graded layers through the coating thickness.

Examples in this presentation include thin ceria-based electrolyte coatings for solid oxide fuel cells, including dense coatings near 5  $\mu\text{m}$ , nanostructured SOFC functional layers, biomimetic substituted hydroxyapatite coatings, reactive synthesis of Al–Mo powders, and protective nitride coatings for contact with aggressive liquid Al–Mg alloys. The purpose is to show how one RF plasma platform can connect powder synthesis, coating deposition, and materials development across energy, biomaterials, and industrial processing. RF inductively coupled plasma technology is part of the history of thermal spraying, but it is also part of its future.

**Biography:**

Dr. François Gitzhofer is an Associate Professor in the Department of Chemical and Biotechnology Engineering at the Université de Sherbrooke (Québec, Canada). His work has focused on materials synthesis and coating processes using RF inductively coupled plasma (ICP) technology. He is the inventor of Suspension Plasma Spraying (SPS), which introduced suspension-based feedstocks into plasma spraying and enabled coating formation in a manner comparable to conventional powder injection, while providing a high degree of flexibility in composition without the need for complex powder preparation routes. The process is now widely used in both research and industrial applications. His research has addressed plasma-based processing of advanced coatings and powders. These include applications in biomedical materials, primary industry, thermal and environmental barrier coatings, as well as combinatorial synthesis. In recent years, his activities have extended to the development of solid-state powered RF plasma systems for nanopowder synthesis and powder spheroidization.