TS4E | 2026

Jocelyn Veilleux, Department of Chemical and Biotechnological Engineering, Université de Sherbrooke

Unlocking functional materials synthesis via insights into RF inductively-coupled thermal plasmas

Abstract:
Radio frequency inductively-coupled plasmas (RF-ICPs) offer a unique platform for the high-throughput synthesis of advanced materials, combining electrodeless operation, high chemical purity, and extreme reactive environments. As precursor delivery strategies have evolved toward mixed powders, solutions, and suspensions, the resulting plasma-chemistry interactions have become increasingly complex. Recent advances in optical emission spectroscopy (OES), particularly through molecular band analysis, now provide powerful in situ insights into plasma reactive species and formation mechanisms.

This contribution presents recent developments at Université de Sherbrooke focusing on the RF thermal plasma synthesis of functional materials for energy and coating applications. Solid precursors were successfully employed to produce Li_2S nanostructures for lithium battery electrodes, while solution precursors enabled the synthesis of $LiFePO_4$ as well as garnet-type solid-electrolyte materials. In parallel, complex oxide perovskites, including $Ba(Mg_{2/3}Ta_{1/3})O_3$ with vertically oriented grains, were synthesized for advanced thermal barrier coatings, with OES used to elucidate phase formation pathways. Finally, the controlled synthesis of graphene nanoflakes and carbonaceous coatings is discussed in relation to plasma operating parameters, demonstrating the versatility of RF thermal plasmas for scalable manufacturing of advanced materials.

Biography:
Jocelyn Veilleux is a Full Professor and Head of the Department of Chemical and Biotechnological Engineering at the Université de Sherbrooke. He previously served as Director of the Plateforme de recherche et d'analyse des matériaux (PRAM), one of UdeS's key infrastructures dedicated to advanced materials characterization and development. With training in engineering physics and chemical engineering, Prof. Veilleux specializes in the science and engineering of thermal plasmas. His research focuses on the synthesis of advanced powders, the development of functional materials, and the fabrication of next-generation coatings using suspensions, solutions and hydrocarbons as precursors. He works closely with industrial partners to accelerate the translation of plasma-based technologies into real-world applications. His expertise also covers multiphysics modeling and optical emission spectroscopy for understanding high-temperature plasma systems. His research has contributed to major advances in active material for energy storage, in preparing carbon nanostructures at the pilot scale, as well as innovative approaches to thermal barrier coatings, including applications in novel turbine architectures.