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Advanced Materials Synthesis by Radio-Frequency (RF) Thermal Plasma Technologies

Abstract:

Plasma, as derived from strongly ionized gases, and often described as the fourth state of matter consists of a mixture of electrons, ions and neutral gaseous species. Strong ionization of gases is not generally achieved by combustion process. Therefore, the formation of CO and CO₂ is negligible in a plasma process when the plasma gas is reductant. So, Radio-Frequency (RF) thermal plasma is particularly attractive for application to advanced processes which can decrease the greenhouse gas effluents released to atmosphere. For many applications, RF thermal plasmas which generate gas temperatures in excess of 4000°C are considered adequate for many high temperature's applications. RF plasma torch is electrodeless with very high control of the chemical atmospheres. This technology provides high throughput in a continuous process. A review of the most interesting chemical synthesis by RF plasma reactors from laboratory studies to commercial scale will be presented. Many powders and nanomaterials synthesis will be discussed such as carbon nanostructures (carbon nanotube, fullerene, graphene, etc.); refractory nitrides, carbides and borides; oxides, elemental Si; powder spheroidization; etc. Perspectives on future development with RF thermal plasma reactors will be addressed.

Biography:

Gervais Soucy, PhD in chemical engineer, is internationally recognized for his contributions to thermal plasma technology development (Radio-Frequency (RF) plasma and Direct Current plasma torch (DC)), carbon nanostructure synthesis, high temperature diffusion and reactive phenomena, and the development of chemical metallurgical processes, including hydrometallurgy, electro technologies, pyrometallurgy, and mineral processing. He has published 104 published articles/chapters; 72 peer-reviewed presentations; 52 presentations at national and international conferences; 5 patents; more than 40 confidential reports covering both industrial applications—such as submerged plasma, RF plasma nanomaterial synthesis, and aluminum technologies—and fundamental scientific aspects.