International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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Solution Precursor Plasma Spray (SPPS) Technology

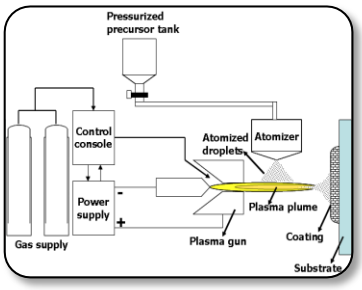
Overview

SPPS is an exciting method to produce a wide variety of functional oxide ceramic coatings, starting with appropriate solution precursors in contrast to powder feedstock in case of conventional plasma spraying. The technique utilizes aqueous/organic chemical precursor solutions fed into the high temperature plasma plume through a dedicated delivery device. The solvent vaporizes as the droplet travel downstream to form solid particles, and are heated & accelerated to the substrate to form finely structured coating deposits.

Key Features

The SPPS process opens up new avenues for developing compositionally complex functional oxide coatings, with the following benefits:

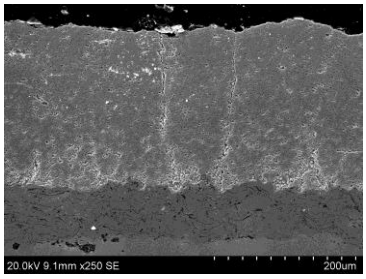
- ability to create nanosized microstructures without any feeding problems normally associated with powder-based systems,
- flexible, rapid exploration of novel precursor compositions and their combinations
- circumvention of expensive powder feedstock preparation steps,
- better control over the chemistry of the deposit



Schematic of SPPS process

Potential Applications

- YSZ based TBCs for gas/steam turbine applications
- Pure α-Al_2O_3 based dielectric coatings
- Graphene films for wear resistance, energy storage applications
- LSM, $LiFePO_4$, etc for electrodes (anode & cathode) of SOFCs/Li-Ion Batteries
- Ferrites and Titania for photocatalytic applications
- Solar absorption coatings



YSZ coating with vertical cracks & distributed pores

Intellectual Property Development Indices (IPDI)

- Developed wide ranging functional coatings for diverse industrial applications
- Prototype demonstration of various coatings is in progress

Status	1	2	3	4	5	6	7	8	9	10

Major Patents / Publications

1. Easwaramoorthi Ramasamy, Sivakumar Govindarajan, Shrikant Joshi, Production of Graphene based Materials by Thermal Spray, ARCI patent appln. no. 2626/DEL/2015
2. G. Sivakumar, R.O. Dusane, and S.V. Joshi, "Understanding the Formation of Vertical cracks in Solution Precursor Plasma Sprayed Yttria-Stabilized-Zirconia Coatings", Journal of American Ceramic Society, 97(11), 3396-3406, 2014
3. G. Sivakumar, Rajiv O. Dusane and Shrikant V. Joshi, A novel approach to process phase pure α-Al2O3 coatings by solution precursor plasma spraying', Journal of the European Ceramic Society, 33 (2013) 2823–2829

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