

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

Balapur P.O., Hyderabad – 500005, Telangana, India



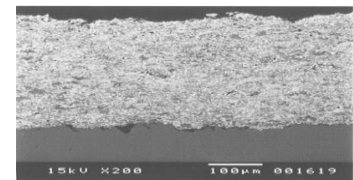
## Detonation Spray Coating Technology (DSC)

### Overview

DSC is a thermal spray process capable of producing coatings with extremely good adhesive strength, and low porosity with compressive residual stresses. Metered proportion of the combustion mixture comprising of oxygen and acetylene (oxy-fuel: OF ratio) is fed through a tubular barrel closed at one end. The gas mixture inside the chamber is ignited by a simple spark plug and the combustion generates high pressure shock waves (detonation wave), which then propagate through the gas stream. Simultaneous admission of the coating powder fed into the combustion chamber results in particle acceleration while the temperature of the hot gas stream can go up to 4000 deg C depending on the OF ratio employed. The hot gases generated in the detonation chamber while travelling down the barrel at a high velocity rapidly heats the particles to a plasticizing stage (skin melting) and also accelerate the particles to a velocity of 800-1200m/sec. These particles then come out of the barrel and impact the component surface to form the coating. The high kinetic energy of the semi-molten powder particles upon impact with the substrate result in formation of a very dense coating. The chamber is finally flushed with nitrogen to clean the barrel for subsequent detonation cycle to obtain thicker coatings. Depending on the required coating thickness and the type of coating material, the detonation spraying cycle can be repeated at the rate of 3 shots per second.

### Key Features

- Good adhesion strength (>10000 psi)
- Dense microstructure (< 1%)
- Negligible thermal degradation
- Good surface finish (~4-6  $\mu\text{m Ra}$ )
- Ability to coat wide range of powders
- Lower substrate temperature & low oxide content
- Good tribological properties
- Coatings with 50-2000 microns thickness can be produced



Detonation spray coating is on progress Typical microstructure of WC-12Co coating

### Potential Applications

- Steel industry application such as Bridle rolls
- Textile & Paper industry applications such as wire passing pulleys, plungers, steeped cone pulleys, bearing stopper plates, guide rolls
- Gas compressor applications such as spindle valve, compressor disc, compressor shaft
- Strategic applications like HP & LP turbine blades, compressor discs, LCA nozzles, thrust bearing sleeves, propeller shaft seals.
- Power and Energy applications such as guide vanes, spindle valves, hydro turbine blades.



Seal runners



Refurbished turbine blades of power plants



Propeller shaft seal



Bearing stopper plates



Printing roll & aero-engine ring

### Intellectual Property Development Indices (IPDI)

- Multiple number of prototype industry scale systems were thoroughly tested and transferred to technology receivers across the country
- Coating production using DSC is fully streamlined

Status	1	2	3	4	5	6	7	8	9	10
--------	---	---	---	---	---	---	---	---	---	----

### Major Patents / Publications

- D. Srinivasa Rao et al, Detonation Sprayed Coatings for Aerospace Applications, in "Aerospace Materials and Material Technologies", Ed: N.E. Prasad, R.J.H. Wanhill, Pubs: Indian Institute of Metals Series, Springer Science + Business Media, Singapore, 2017, pp: 483-500, ISBN: 978-981-10-2143-5, Article DOI: 10.1007/978-981-10-2134-3\_22.
- D.Srinivasa Rao et al, "Detonation Sprayed Coatings and Their Tribological Performance" in Thermal Sprayed Coatings and Their Tribological, M. Roy, & J. Davim (Eds.) Thermal Sprayed Coatings and their Tribological Performances, IGI Global, 2015. (pp. 294-327). Hershey, PA: Engineering Science Reference. doi:10.4018/978-1-4666-7489-9.ch010

### Centre for Engineered coatings (COAT)

ARCI, Balapur PO., Hyderabad 500005, Telangana, India  
Tel : +91 40 24452374 / 24452342; Fax : +91 40 24442699

Email: dsen[at] arci [dot] res [dot] in / dsrao [at] arci [dot] res [dot] in / director [at] arci [dot] res [dot] in