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

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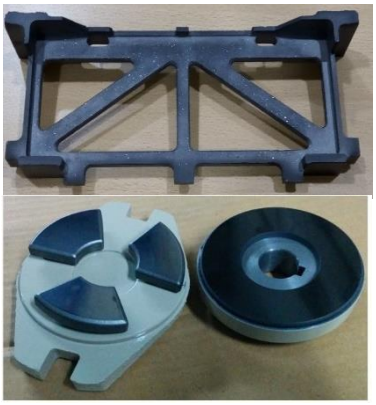
Sintered silicon carbide (SiC) components

Overview

Silicon carbide (SiC) is one of the most attractive ceramic materials because of its excellent mechanical properties such as high strength, moderate toughness, and high wear and oxidation resistance, and strength retention at elevated temperature. ARCI has the expertise to manufacture SiC parts with various size and shapes by pressureless sintering using solid-state or liquid phase sintering additives and also by hot pressing technique. SiC parts of complex geometry can also be manufactured through machining at the green stage using 5-axis CNC machine. Dimensional accuracy can also be achieved on sintered SiC parts by final shaping with the help of sophisticated ultrasonic machining.

Key Features

- Tuneable density and other thermo-mechanical properties.
- Flexibility in producing SiC parts incorporating solid-state or liquid phase sintering additives.
- Capable to produce SiC components up to 750 mm diameter.
- SiC parts with critical can be manufactured.



Complex shaped sintered SiC parts for aerospace applications

Potential Applications

- Mechanical seals particularly for corrosive environment.
- Impact and abrasion resistance parts.
- Light-weight structural parts for aerospace applications.
- Impact and wear resistant parts.

3-axis ultrasonic machining facility

Technology Readiness Level

- The technology has been validated for production of various size and shape SiC parts by pressureless sintering and available for technology transfer.

IPDI*	1	2	3	4	5	6	7	8	9	10
Activities	*Basic concepts and understanding of underlying scientific principles*	*Short listing possible applications*	*Research to prove technical feasibility for targeted application*	*Coupon level testing in stimulated conditions*	*Check repeatability/ consistency at coupon level*	*Prototype testing in real-life conditions*	*Check repeatability/ consistency at prototype level*	*Reassessing feasibility (IP, competition technology, commercial)*	*Initiate technology transfer*	*Support in stabilizing production*
Status										

Major Publications

1. P. Barick, **D. C. Jana** and B.P. Saha, Load-dependent indentation behaviour of β-SiAlON and α- Silicon carbide, *Journal of Advanced Ceramics,* 2, (2013), 185-192.
2. S. V. A. Raj, **D. C. Jana,** P. Barick and B. P. Saha, Microstructure Evolution in Densification of SiC Ceramics by Aluminium Vapour Infiltration and Investigation of Mechanical Properties, *Ceram. Inter.,* 44 (2018), 9221-9226
3. **D. C. Jana**, P. Barick and B. P. Saha, Effect of Sintering Temperature on Density and Mechanical Properties of Solid-State Sintered Silicon Carbide Ceramics and Evaluation of Failure Origin, *J. Mater. Eng. Perform.,* 27 (2018), 2960-2966.
4. **D. C. Jana,** G. Sundararajan and K. Chattopadhyay, Effective activation energy for the solid-state sintering of silicon carbide ceramics, *Met. Mater. Trans. A,* Vol 49 A (2018), 5599-5606.

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