Advertisement for Incubation of Technology

Title of the technology	**Sintered SiC based composite ceramic**

Current state of Technology

- ✓ Basic principles observed
- ✓ Technology concept formulated
- ✓ Experimental proof of concept
- ✓ Technology validated in lab
- ✓ Demo system available

General Information

Silicon carbide based material has been developed (work is under progress) for nuclear application – accident tolerant fuel clad and clad for high temperature reactor. Pressureless sintered SiC is the spin-off of that activity. The secondary phase present in this product is more than desirable limit prescribed for nuclear application. However, these materials have potential to be used in armor application. A comprehensive testing is required to generate data for the above mentioned activity.

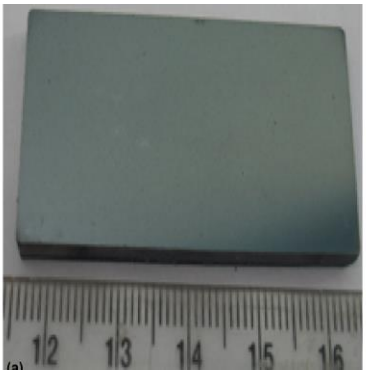
Features/Specification of system

Parameters	***For Current System***	***For Target System***
Temperature-1	1500 °C	>1600 °C
Temperature-2	1850 °C	>2000 °C
Density	75-95 %	>97 %
Hardness	2300 (HV(0.1) Kg/sq mm)	2800 (HV(0.1) Kg/sq mm)
Fracture toughness	3.5 $MPa\sqrt{m}$ (Indentation)	> 5.0 $MPa\sqrt{m}$ (Indentation)

Working of the System (with schematic block diagram)

Densification of SiC is carried out by different techniques. Amongst them, pressureless sintering is most cost-effective. Pressureless sintered SiC is a cost effective body armor material and clad tube for future generation nuclear reactor.

Photograph(s) of the System –



(a) In-house made SiC (density > 95% TD)

(b) SiC tube having > 75% TD

Applications of the System

Defense as body armor, high temperature reactor, semiconductor industry.

Whether the parent product/ technology/ process is patented: ~~Yes~~/ ✓No

If yes, provide the details – N/A

Deliverables – (a) Technology for making >97 % dense SiC in size 5x4x0.5 (in cm) or more

(b) Technology to improve fracture toughness of SiC from 3.5 $\mathrm{MPa}\sqrt{\mathrm{m}}$ to more than 5 $\mathrm{MPa}\sqrt{\mathrm{m}}$ by incorporating carbon nano tube as dispersed phase.

(c) Technology for developing impervious SiC tube of dimension 12 mm ID, 1.0 mm thickness, and 300 mm length.

Justification for Incubation –

To produce in larger scale, maintaining homogeneity in large product and testing in actual environment (for body armor material).

Facility and Infrastructure to be provided by Incubatee/BARC:

<table>
<tr><th>Title Head</th><th>To be provided by BARC</th><th>To be provided by Incubatee</th></tr>
<tr><td>Manpower/ expertise</td><td>2 SO, 2 Technician</td><td>4 skilled labourers, 1 engineering supervisor, 1 decision making authority</td></tr>
<tr><td>Machinery and Equipment</td><td>Press, Furnace</td><td>Press, Furnace, Machining facility, Cutter</td></tr>
<tr><td>Others</td><td></td><td>Testing against API</td></tr>
<tr><td colspan="3">Economic Viability:</td></tr>
<tr><td>a. Investment and unit cost of production</td><td colspan="2">Expression of Interested is invited from a reputed manufacturer who already has experience and related infrastructure for sintered non-oxide ceramics used for ballistic application.
Unit cost of the finished product is expected to be in the range of 75-80 USD per kilogram</td></tr>
<tr><td>b. Imported/indigenous market price of equivalent technology/ process/ product, if available.</td><td colspan="2">Imported sintered SiC based composite costs around 150-175 USD per kilogram</td></tr>
<tr><td colspan="3">Special Requirements:</td></tr>
<tr><td>Any special requirements for plant, industry, location utilities, handling storage, safety etc.</td><td colspan="2">Experience more than 7 years in manufacturing dense carbide/boride ceramics</td></tr>
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Note: As per in-house technology incubation policy, the incubatee should be a licensee of the existing technology. Alternatively, the applicant will be required to take the license of the existing technology before entering incubation agreement.

If interested in Incubation, kindly ***download -> fill -> scan -> send*** the application form to -

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Knowledge Management Group
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