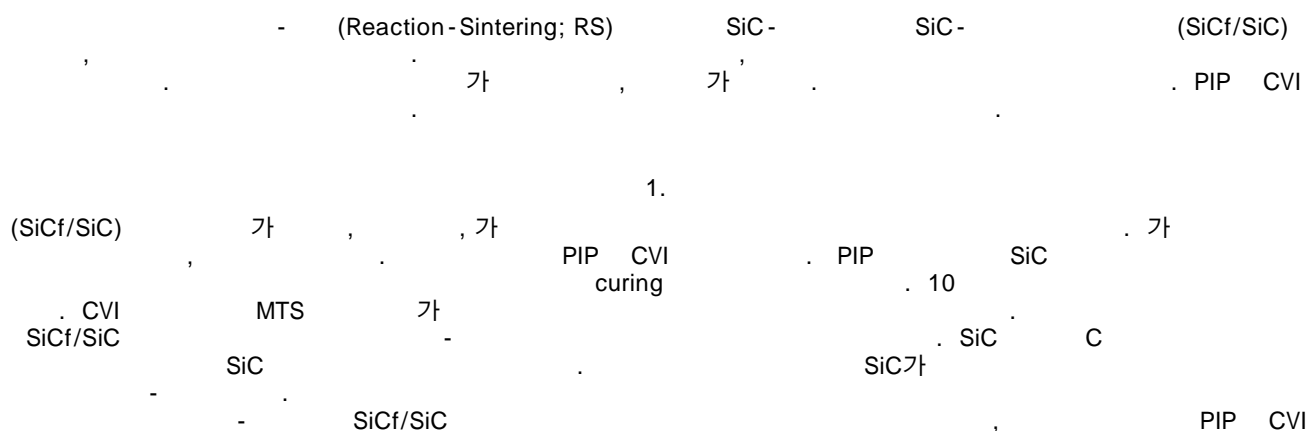


SiC

<Development of a reaction-sintered silicon carbide matrix composite>

by A. Sayano, C. Sutoh, S. Suyama, Y. Itoh, S. Nakagawa, from J. of Nuclear Materials, 271 & 272, 467-71 (1999).



2. Experimental

Fig. 1 SiCf/SiC(RS)
 Hi-Nicalon 14 μ m 2000
 가 1720 K 가 5
 1000 oC flash I-V Fig. 2
 SEM Fig. 1 200 900 oC (140x140x6 mm³) 30
 SiC C
 slip impregnation green
 CVD 13
 40x10x1 mm³, Poisson
 10 mm x 1.2 mm 1300 oC
 SiC 20x20x2.5 mm³
 50 mm, 3 mm

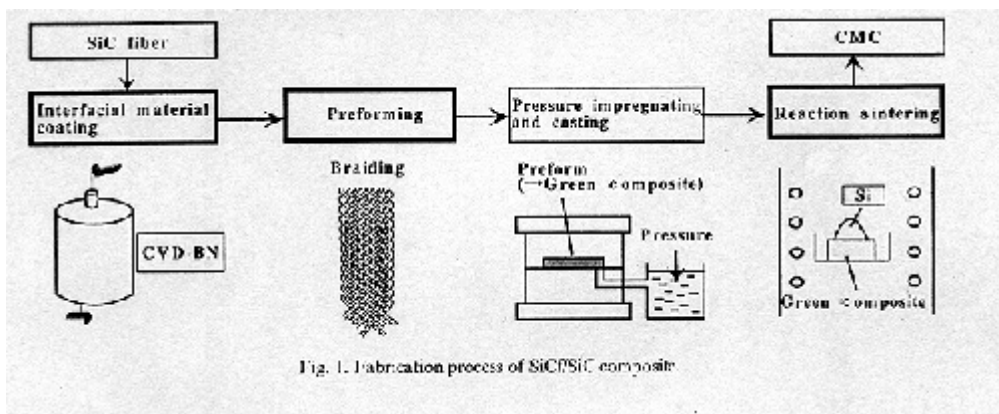
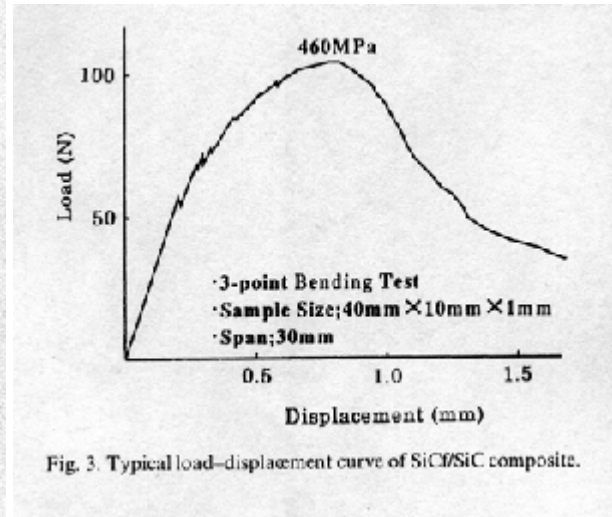
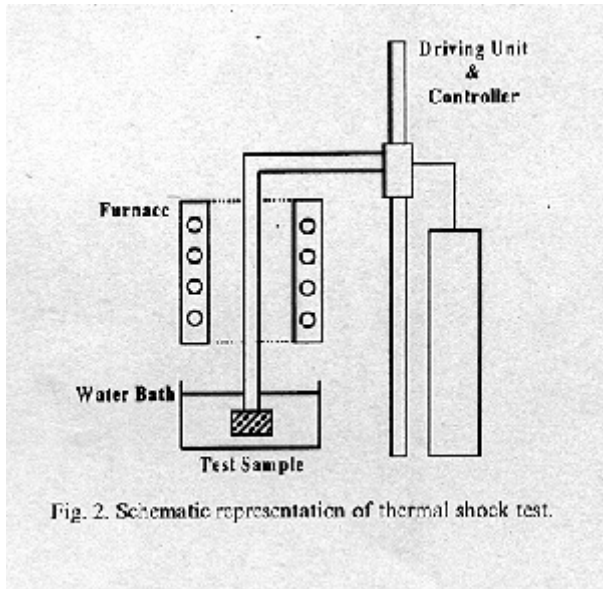


Fig. 1. Fabrication process of SiC/SiC composite



3. Results and discussion

Table 1

PIP CVI

가 가 PIP CVI

가 가

SiC가 15-20 %

가 가

V-I 가

SiC/SiC

10 CVI PIP-CVI

460 MPa 200 MPa Fig. 3 3 SIC 가 PIP CVI

Fig. 4 3 100 MPa PIP CVI

가

Table 2

600 oC

400 oC

Fig. 5 (900 oC->) Fig. 6

Fig. 7

CMC

가 C14 SiC/SiC(RS) 가

SiC

가

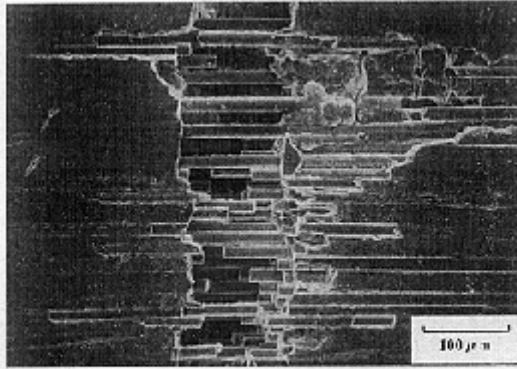


Fig. 4. Crack opening region following three-point bending test.

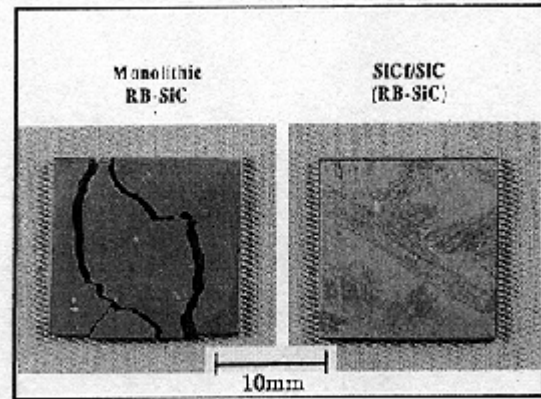


Fig. 5. Thermal shock test results (500°C → water).



Fig. 6. Microstructure of SiC/SiC composite after thermal shock test.

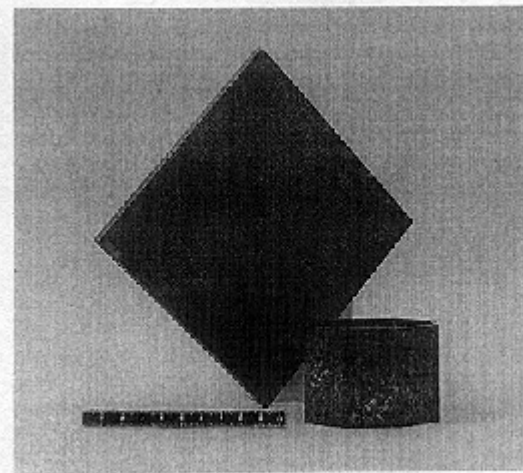


Fig. 7. SiC/SiC composite prototypes.

Table 1
Properties of SiC/SiC composite

Process	Reaction bonding	PIP (polymer impregnation and pyrolysis)	CVI (chemical vapour infiltration)
Structure			
Fiber	Hi-Nicalon	Nicalon	Nicalon
Fiber volume fraction	30% (braid)	30% (cloth laminate)	40% (cloth laminate)
Density	3.0 g/cm ³	1.9 g/cm ³	2.6 g/cm ³
Porosity	~2%	~23%	8-15%
Properties			
Heat resistant temperature	1350°C	1000°C	1200°C
Young's modulus	240 GPa	50 GPa	230 GPa
Tensile strength	500 MPa	110 MPa	200 MPa
Poisson's ratio	0.2	-	-
Thermal conductivity	50 W/m K (RT) 30 W/m K (1000°C)	0.56 W/m K (500°C) 0.73 W/m K (700°C)	9.7 W/m K (RT) 6.2 W/m K (1000°C)
Coefficient of thermal expansion	4.9 × 10 ⁻⁶ K ⁻¹ (Y-direction) 4.7 × 10 ⁻⁶ K ⁻¹ (X-direction), RT - 1300°C	3.6 × 10 ⁻⁶ K ⁻¹	3 × 10 ⁻⁶ K ⁻¹ (Z) 2.5 × 10 ⁻⁶ K ⁻¹ (L)
Reactivity	13 Ω cm (Y-direction) (at 1 A/cm ²) 0.9 Ω cm (Z-direction)	-	-
Characteristic	Productivity; good complicated shape; possible cost; low	Productivity; not bad complicated shape; possible cost; not high	Productivity; not good complicated shape; possible cost; high

Table 2
Thermal shock test results

Holding temperature (°C)	Monolithic (RB-SiC)		CMC (SiCf/RB-SiC)	
	Micro crack	Crack	Micro crack	Crack
200	none	none	none	none
400	exist	none	exist	none
600	exist	exist	exist	none
800	exist	exist	exist	none
900	exist	exist	exist	none