
Metal Matrix Composites

MMC



NIHON CERATEC CO., LTD.

PROPOSAL

**Are you troubled by heavy iron
and overly flexible aluminum?**

Are you troubled by changes in accuracy due to temperature?

Are you troubled by too much heat?

MMC solves these problems.

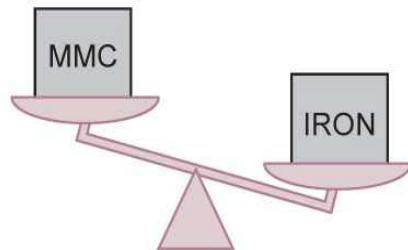
NIHON CERATEC CO., LTD. manufactures and sells Metal Matrix Composites (MMCs), composite materials consisting of metals and ceramics. MMCs are made of metallic matrices with uniformly distributed reinforcing materials (such as SiC and Al₂O₃, etc.).

They are manufactured by high pressure metal infiltration and non-pressure.

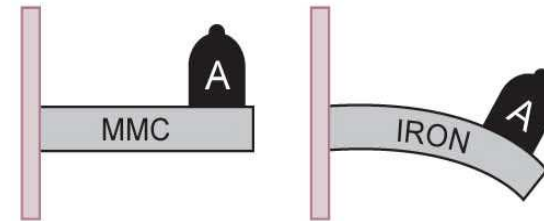
MMCs can be made as lightweighted as an aluminum alloy but as rigid as an iron through appropriate selection of matrix type and reinforcing material content (20-70 wt%). Furthermore, since MMCs have excellent damping properties in addition to low thermal expansion and high thermal conductivity, they can be used in a wide range of applications, such as for machine tools, semiconductor and LCD production equipments and industrial robots.

FEATURES

1 Light Weight



2 High Rigidity



3 Low Thermal Expansion Coefficient

4 High Thermal Conductivity

5 High Vibration Damping

INTRODUCTION

PSH Series

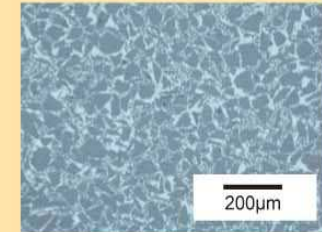
■ SiC/Al, Al₂O₃/Al, etc.

This is a composite material made of SiC ceramic particles contained in a aluminum.

It is manufactured by the high pressurer metal infiltration method.



Plate (φ200×t25mm)



PSA Series

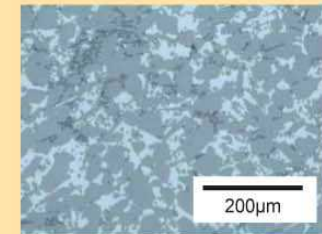
■ SiC/Al-Si

This is a composite material made of SiC ceramic particles contained in a silicon and aluminum.

It is manufactured by the pressureless metal infiltration method.



XY Stage (500×300×H40mm)



PSS Series

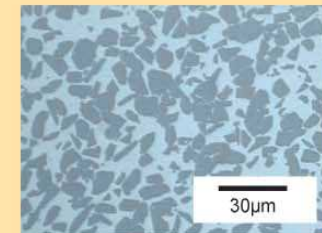
■ SiC/Si

This is a composite material made of SiC ceramic particles contained in a silicon.

It is manufactured by the pressureless metal infiltration method.



Pin formed (φ200×t5mm)



INTRODUCTION

PSH Series

■ SiC/Al, Al₂O₃/Al, etc.

This is a composite material made of SiC ceramic particles contained in a alumium.

It is manufactured by the high pressuer metal infiltration method.

PSA Series

■ SiC/Al-Si

This is a composite material made of SiC ceramic particles contained in a silicon and alumium.

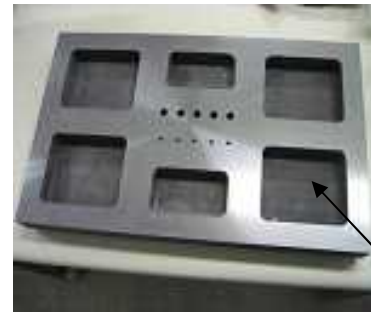
It is manufactured by the pressureless metal infiltration method.

PSS Series

■ SiC/Si

This is a composite material made of SiC ceramic particles contained in a silicon.

It is manufactured by the pressureless metal infiltration method.



casted surface



Screw hole & Helisert



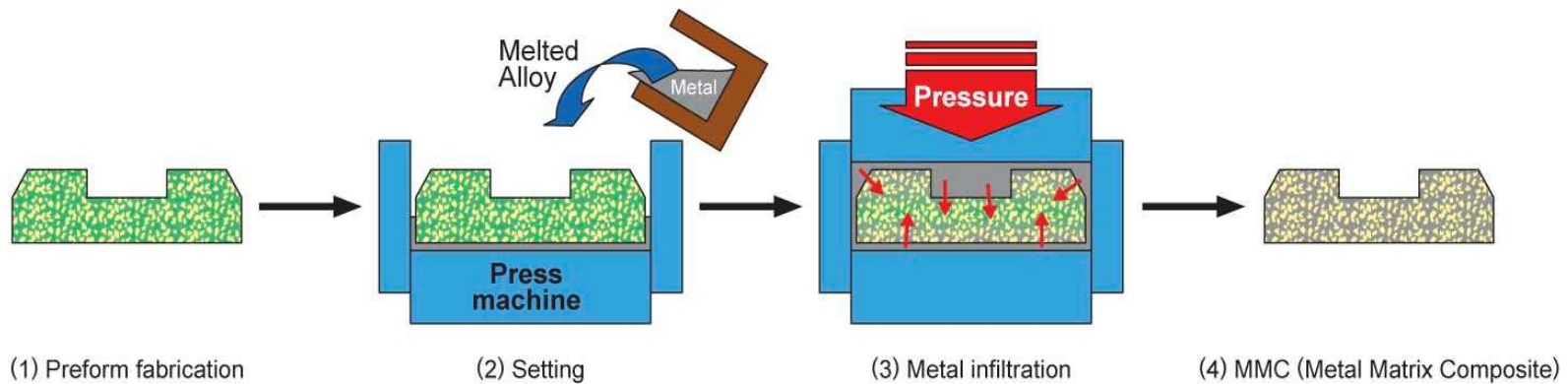
Φ200 Plate
Mirror Finish



Honeycomb
structure

PROCESS

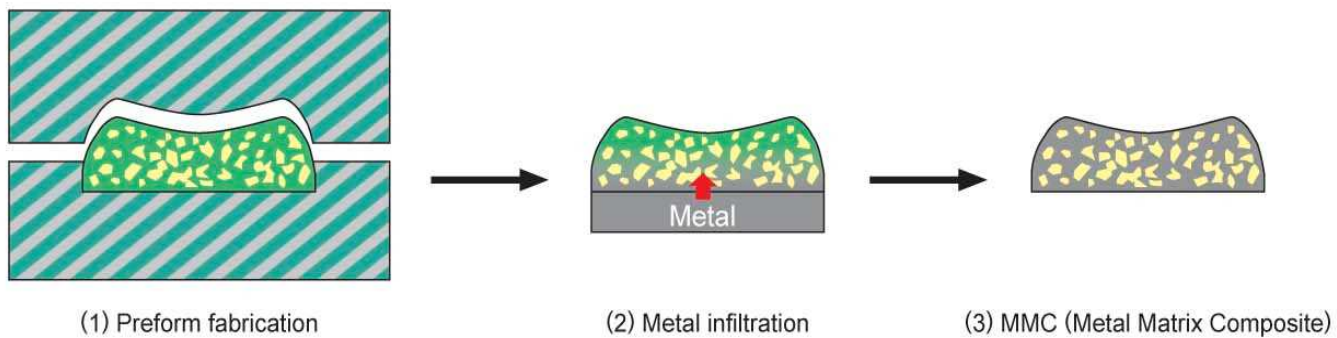
PSH PROCESS



- (1) Molten metal and ceramic reinforcing material can realize combination and unification by pressure.
Ceramic reinforcing material can be contained up to 70 vol%.
- (2) Broad control of the characteristics is possible by combination of the type and particle diameter of the reinforcing material, the matrix metal composition, the reinforcing material content and other factors.

PROCESS

PSA·PSS PROCESS



Molten metal and ceramic reinforcing material can realize combination and unification without pressurizing.
Ceramic reinforcing material can be contained up to 70 vol%.

METAL MATRIX COMPOSITES

Item	Unit	PSH- S1	PSH- A1	PSS	PSA-1	Metal		Ceramics
		SiC/Al	Alumina /Al	SiC/Si	SiC/Si·Al	Aluminum AC8A	Cast Iron FC250	99.5% Alumina
Density	g/cm ³	3.0	3.5	2.8	3.0	2.7	7.3	3.9
Young's Modulus	GPa	230	210	280	300	80	114	390
Bending Strength	MPa	340	420	300	240	—	—	450
Fracture Toughness	MN/m ^{3/2}	8	8	3	4	—	—	4
Hardness		20 HRC	90 HRB	—	—	—	—	1800HV
Thermal Expansion Coefficient	10 ⁻⁶ /K (~200°C)	8.3	11.3	2.8	4.1	20	9.8	5.4
Thermal Conductivity	W/m·K	165	80	175	165	125	47	30
Specific Resistance	Ω·cm	4 × 10 ⁻⁵	3 × 10 ⁻⁵	2 × 10 ⁻²	5 × 10 ⁻²	3 × 10 ⁻⁶	—	>10 ¹⁴
Feature		<ul style="list-style-type: none"> · Lightening of the weight · High Stiffness 	Resist plasma	Low Expansion	<ul style="list-style-type: none"> · Lightening of the weight · High Stiffness · Low Expansion 			