

Material designation:
RaFo-MF-401-C

Introduction:

This Material was developed as a ceramic foam. It is characterized by a highly porous structure. It can be realized almost each basic geometry. The ceramic matrix is based on $\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$ and shows high strength. The defined ratio of pore distribution, pore size and pore volume is decisive for the very good thermal shock resistance. This enables a quick heating interval for the application process. Due to the low density, this material shows a very low specific heat storage capacity. By using this material as refractory or kiln outlining, the energy efficiency can be affected positively.

Possible applications:

- Ceramic cores for ceramic filters
- High temperature refractories
- High temperature furnace thermal isolation
- High temperature carrier supports

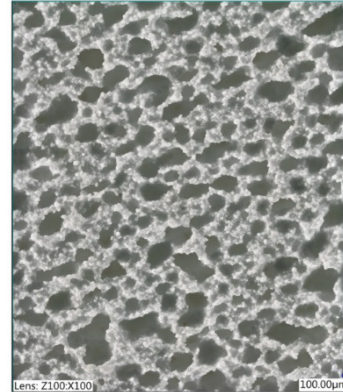


Fig. 1. Typical view of cross-section structure

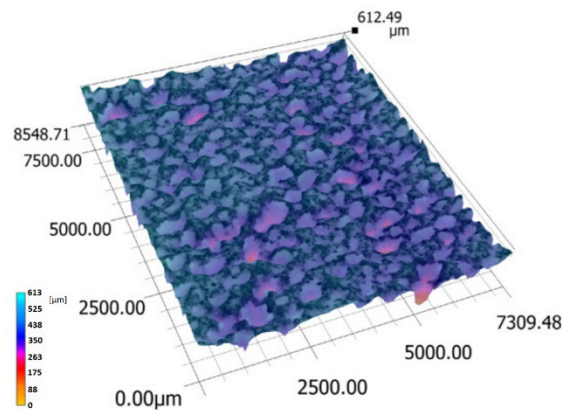


Fig. 2. Typical view of digital reconstruction of cross-section

Basic parameters:

Material basis:	$\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$ (Mullite)
Max. operating temp. [°C]:	1600
Water absorption [%]:	64.6 ± 6.6^1
Open porosity [%]:	69.5 ± 2.91^1
Matrix density [g/cm ³]:	3.52 ± 0.3^1
Density [g/cm ³]:	1.08 ± 0.075^1
Young modulus [GPa]:	1.42 ± 0.57^1
Breaking strength (3-Pt) [MPa]:	1.04 ± 0.42^1
Breaking strength (3-Pt) after thermal shocks [MPa] ² :	0.84 ± 0.48^1
Permeability [l/(s·m ²)]:	$6.43 \pm 5.52^{1,3}$
Matrix [%]/ Pore ratio [%]:	81.64/18.36

¹ Deviation is given as ± 3 standard deviations

² Result after single thermal shock at 1000°C

³ Rough estimation for initial research project needs

All data were obtained under ideal conditions in the laboratory and are guideline values!

Pore characteristics

Pore class [eqv.Diam]	Occurrence of Pores [%]
>0-3 µm	53.89
>3-5 µm	29.43
>5-10 µm	12.55
>10-50 µm	2.54
>50-100 µm	0.40
>100-200 µm	0.41
>200-300 µm	0.25
>300-400 µm	0.21
>400-500 µm	0.16
>500-600 µm	0.09
>600-650 µm	0.03
>650 µm	0.05

Chemical composition
 (Calculated from chem.
 Analysis of the raw material
 datasheets)

Al ₂ O ₃	87,55 %
SiO ₂	11,42 %
Na ₂ O	0,37 %
Fe ₂ O ₃	0,14 %
TiO ₂	0,09 %
K ₂ O	0,44 %

Coefficient of thermal expansion (CTE)

Temp. Range [°C]	CTE [ppm/K]	Temp. Range [°C]	CTE [ppm/K]
200-1500	7.2622	1500-200	7.8774
200-400	6.3996	1500-1400	9.3953
400-600	7.1088	1400-1200	8.7858
600-800	7.4731	1200-1000	8.5359
800-1000	7.8890	1000-800	8.3635
1000-1200	7.9321	800-600	7.7898
1200-1400	7.6201	600-400	7.1874
1400-1500	5.5634	400-200	5.8428