Material designation:
RaFo-MF-401-D

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 Al_2O_3□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.

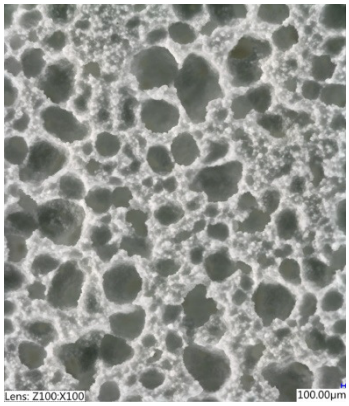

Fig. 1. Typical view of cross-section structure

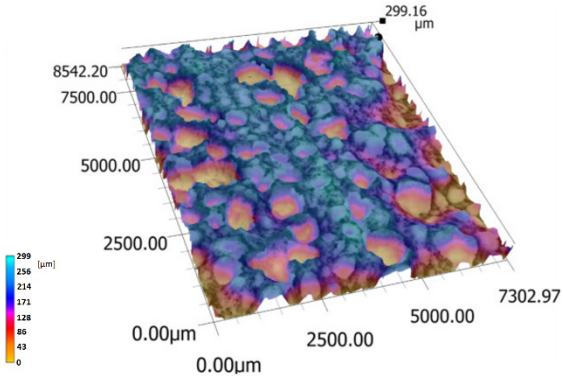

Fig. 2. Typical view of digital reconstruction of cross-section

Possible applications:
Ceramic cores for ceramic filters
High temperature refractories
High temperature furnace thermal isolation
High temperature carrier supports

Basic parameters:

Material basis:	$Al_2O_3 \cdot SiO_2$ (Mullite)
Max. operating temp. [°C]:	1600°C
Water absorption [%]:	64.9±7.3[1]
Open porosity [%]:	68.8±3.1[1]
Matrix density [g/cm³]:	3.41±0.22[1]
Density [g/cm³]:	1.06±0.08[1]
Young modulus [GPa]:	1.61±1[1]
Breaking strength (3-Pt) [MPa]:	1.16±0.43[1]
Breaking strength (3-Pt) after thermal shocks [MPa][2]:	0.99±0.43[1]
Permeability [l/(s*m²)]:	14.53±4.68[1, 3]
Matrix [%]/ Pore ratio [%]:	73.8/26.2

[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*

Pore characteristics

Pore class [eqv.Diam]	Occurrence of Pores [%]
>0-5 µm	79.40
>5-10 µm	16.45
>10-20 µm	2.69
>20-100 µm	0.93
>100-300 µm	0.32
>300-500 µm	0.12
>500-700 µm	0.03
>700-900 µm	0.02
>900-1100 µm	0.01
>1100-1300 µm	0.02
>1300	0.01

Chemical composition

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

Al_2O_3	84,05 %
SiO_2	14,74 %
Na_2O	0,36 %
Fe_2O_3	0,17 %
TiO_2	0,12 %
K_2O	0,56 %

Coefficient of thermal expansion (CTE)

Temp. Range [°C]	CTE [ppm/K]	Temp. Range [°C]	CTE [ppm/K]
200-1500	7.4589	1500-200	7.8876
200-400	6.4125	1500-1400	9.3131
400-600	7.0408	1400-1200	8.8413
600-800	7.4449	1200-1000	8.5046
800-1000	8.0974	1000-800	8.2541
1000-1200	8.0261	800-600	7.7038
1200-1400	8.153	600-400	7.1791
1400-1500	6.6168	400-200	6.1297