Material designation:
RaFo-MF-401-C2

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.

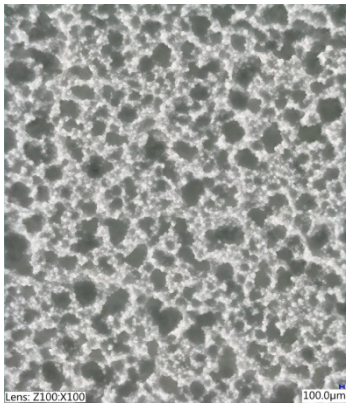

Fig. 1. Typical view of cross-section structure

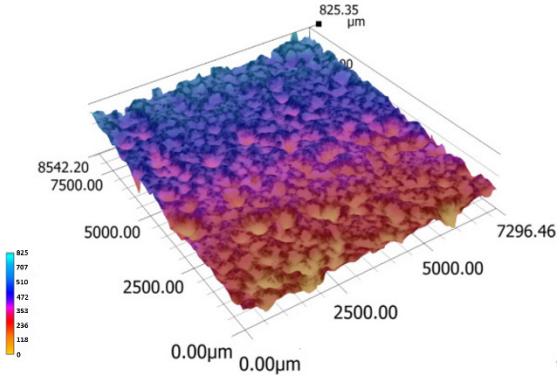

Fig. 2. Typical view of digital reconstruction of cross-section

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 [%]:	61.6±8.1[1]
Open porosity [%]:	68.4±2.8[1]
Matrix density [g/cm³]:	3.53±0.19[1]
Density [g/cm³]:	1.11±0.11[1]
Young modulus [GPa]:	1.38±1.19[1]
Breaking strength (3-Pt) [MPa]:	1.14±1.1[1]
Breaking strength (3-Pt) after thermal shocks [MPa][2]:	0.76±0.52[1]
Permeability [l/(s*m²)]:	6.58±2.55[1, 3]
Matrix [%]/ Pore ratio [%]:	80.49/19.51

[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 [%]
>0-3 µm	58.79
>3-5 µm	28.30
>5-10 µm	10.11
>10-100 µm	1.99
>100-200 µm	0.24
>200-300 µm	0.23
>300-400 µm	0.15
>400-500 µm	0.08
>500-600 µm	0.04
>600 µm	0.06

Chemical composition

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

Al_2O_3	87,55 %
SiO_2	11,42 %
Na_2O	0,37 %
Fe_2O_3	0,14 %
TiO_2	0,09 %
K_2O	0,44 %

Coefficient of thermal expansion (CTE)

Temp. Range [°C]	CTE [ppm/K]	Temp. Range [°C]	CTE [ppm/K]
200-1500	7.9644	1500-200	8.2421
200-400	6.5394	1500-1400	9.8024
400-600	7.3335	1400-1200	9.0715
600-800	7.7905	1200-1000	8.882
800-1000	8.4233	1000-800	8.5708
1000-1200	8.6003	800-600	8.0839
1200-1400	8.8512	600-400	7.4756
1400-1500	8.4602	400-200	6.5888