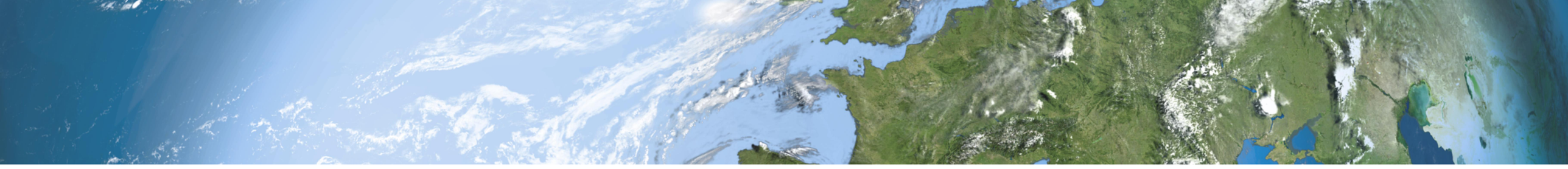


Silica-Aerogels for exhaust systems

a new material for thermal insulation

MOTIVATION

THE PROBLEM

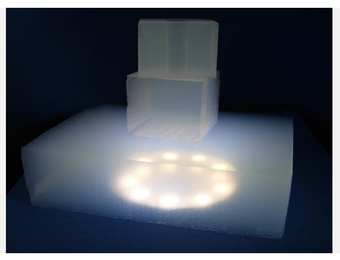
The catalyst in the exhaust system works more effective, when the temperature is high enough (≈ 400° C). The temperature till the entrance of the catalyst. Developing Insulation materials for such temperatures with good mechanical properties is therefore a real challenge.

Fujitsubo exhaust system
Source: redlinemotive.com

We propose to combine quartz glass felts with inorganic silica aerogels to manufacture a new types of generic exhaust system of engines.

AEROGEL

Aerogels are nanostructured highly open-porous solid materials synthesized by sol-gel



Properties:
- ✓High porosity 95 - 99%
- ✓Low density 0.01-0.2 g/cm³
- ✓High specific area 500 - 2000 m²/g
- ✓Low thermal conductivity 0.005-0.03 W/mK

SiO_2-FIBRE-FELT

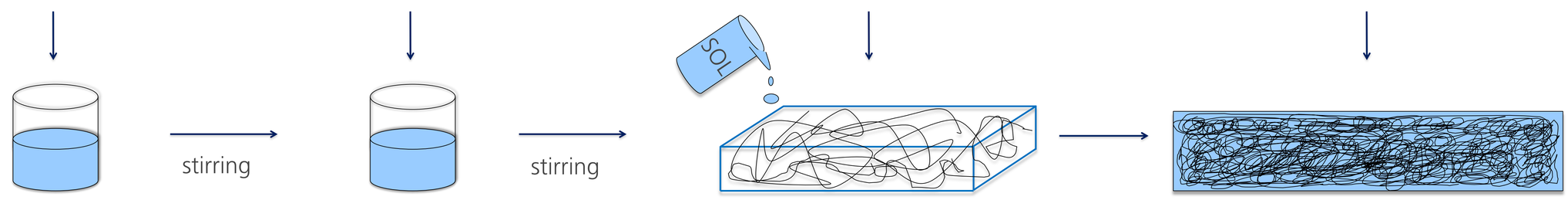
Properties:
- ✓Density 0,13 g/cm³
- ✓Thermal conductivity 0,0534 W/mK at 200 ° C
- ✓Max. temperature 1100° C.
- ✓High heat capacity

COMPOSITE

Half-shell of
SiO_2-fibre-felt filled with SiO_2-Aerogel

SYNTHESIS

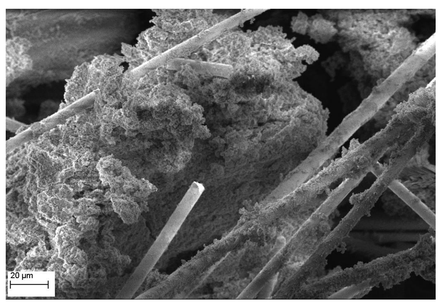
1. TEOS : Water : Ethanol → stirring
2. Ammonium fluoride catalyst → stirring
3. Filling the fibre with sol
4. Gelling, aging, washing and supercritical drying



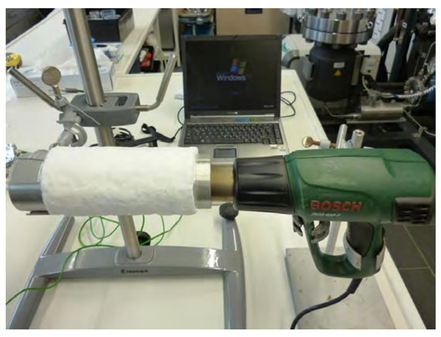
The **gelling** time depends on ammonium fluoride concentration between 10 min or 1 day

aging 1 day at 50° C
washing with ethanol
drying with supercritical CO_2

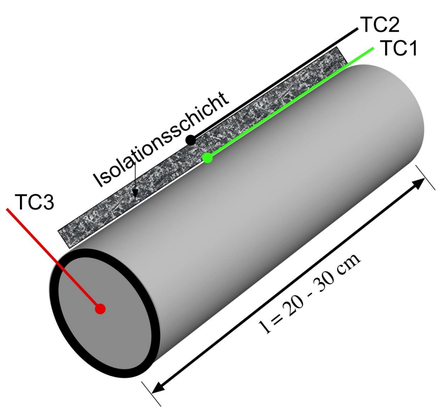
RESULTS AND CONCLUSION



SEM: Mag. 500x
quartz glass felts with inorganic silica aerogels



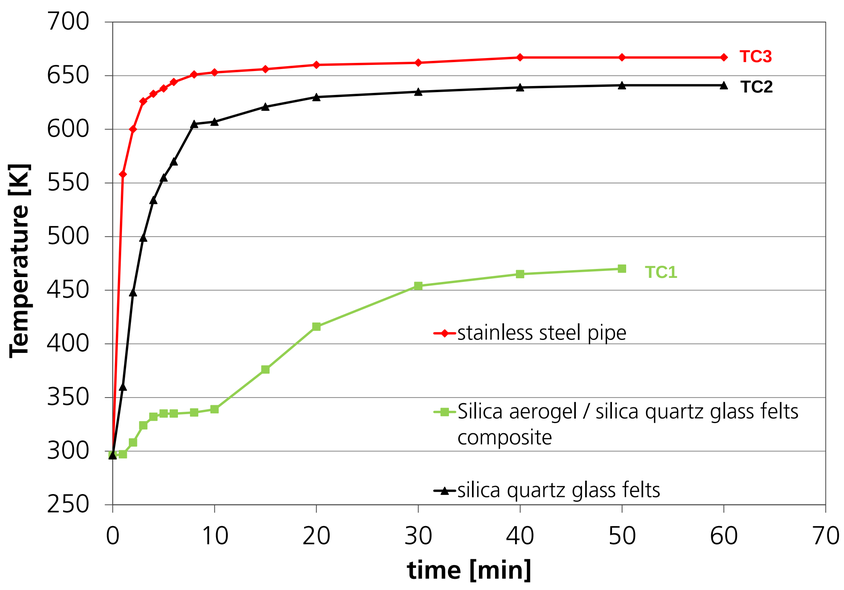
Experiment with a heat gun



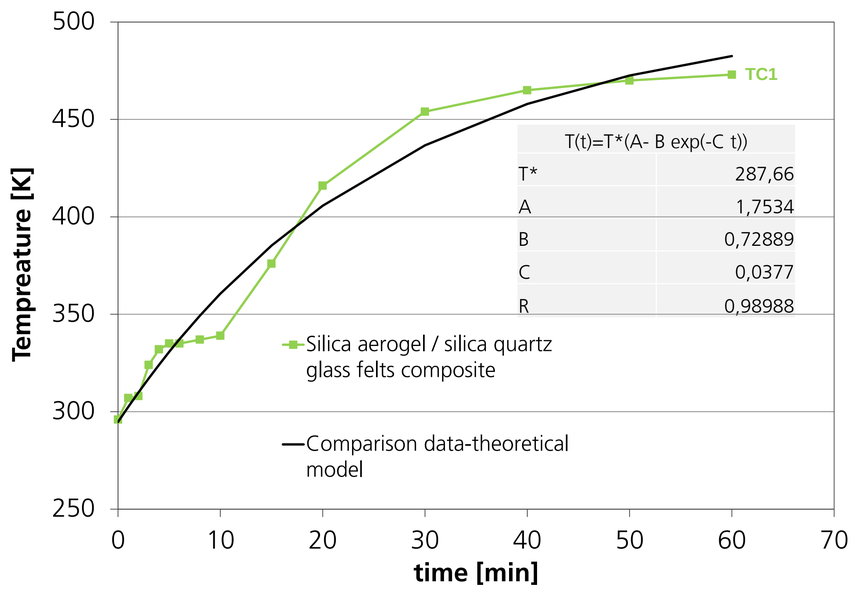
Experiment: schematic

COMPOSITE

PROPERTIES	VALUE	UNIT
Density	0.183	g/cm³
Porosity	84	%
Thermal conductivity	0.038	W/mK
Specific surface area	242	m²/g
Pore volume	0.55	cm³/g
Average pore size	14	nm



Comparison of Temperature resistance



Comparison of experimental data-theoretical model

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