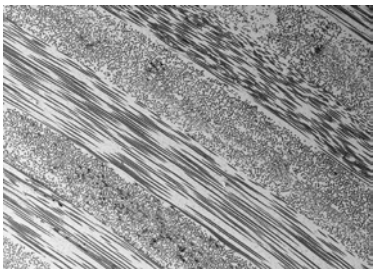
ULTRA-HIGH TEMPERATURE CERAMIC MATRIX COMPOSITES



Microstructure of UHTCMCs

PRODUCTS

UHTCMCs are special ceramic matrix composites created for aerospace applications with superior erosion/ablation resistance and mechanical properties at T>1500°C.

-Properties are highly customizable

-Complex shapes are possible

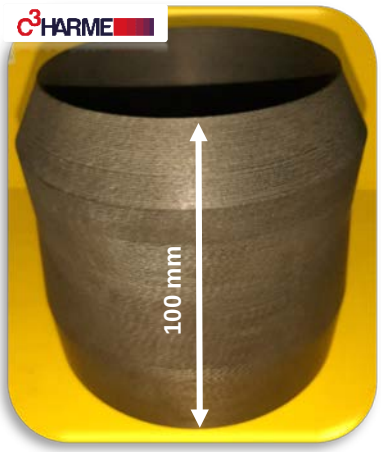
-The innovative and patented process reduces the manufacturing **time to few weeks.**

PROPERTIES

Tiles and rocket motors components made of UHTCMCs have been tested above 2000ºC presenting a stable performance (near zero erosion) for propulsion and thermal protection system (TRL >5).

Typical properties of UHTCMCs based on zirconium diboride (ZrB_2) investigated in the frame of the **European project C3HARME** are reported in the Table.

Typical Properties	Units	Long fiber-based materials	Milled fiber-based materials
Density	g/cm^3	3 – 4	3 – 4
Porosity	%	1 – 10	1 – 30
Fibre amount	vol.%	40 – 60	40 – 60
UHTC phase content	vol.%	60 – 40	60 – 40
Young's modulus [25°C]	Gpa	200 – 300	100 – 200
Bending strength [25°C]	Mpa	300 – 500	≤120
Bending strength [1600-1800°C]	Mpa	400 – 800	≤200
Toughness [RT-1500°C]	MPa·m$^{1/2}$	10 – 20	4 – 6
Retained strength [ΔT=1500 K]	MPa	300 – 500	100 – 200
Interlaminar strength [25°C]	MPa	>50	-
Compression strength [25°C]	MPa	500 – 700 (//) 100 – 200 (T)	≤500
Thermal conductivity [25-1950°C]	W/(m·K)	20-30	100 – n.a.
CTE [25-1300°C]	10^{-6} °C^{-1}	1 – 2 (//) ~8 (T)	-



Long rocket nozzle machined by EDM by a block of UHTCMC

Batch of Rocket nozzles prototypes made of UHTCMCs

Rocket nozzle after test showing near zero erosion in the throat

APPLICATIONS

- Aerospace parts: near zero erosion Thermal Protection Systems (TPS) and rocket nozzles
- Nuclear parts: fusion walls and divertors
- Other applications: refractory linings for molten metal handling, high temperature shielding, furnace elements, braking systems

The spin-off Company

K3RX – Ceramics Extraordinary, is a brand new company launching UHTCMCs in the market

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