

**K3RX**  
EXTREME CERAMICS

K3RX is a brand-new company that is launching UHTCMCs in the market.

Our products have been designed for use in the hot parts of the next generation of hypersonic vehicles and rocket motor inserts for satellite launchers. They demonstrate superior performance compared to conventional materials and exhibit exceptional durability.

K3RX is a deep-tech startup that focuses on developing technologies for extremely harsh environments.

**Contacts:**

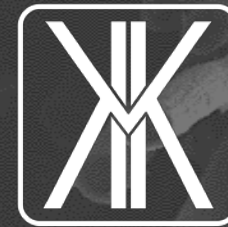
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**ULTRA-HIGH TEMPERATURE  
CERAMIC MATRIX COMPOSITES  
for AEROSPACE**

[www.k3rx.com](http://www.k3rx.com)



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# The Company

K3RX is a spin-off of the National Research Council of Italy, born in 2021 from the EU project H2020 C3HARME – Next generation ceramic composites for harsh environment and space.

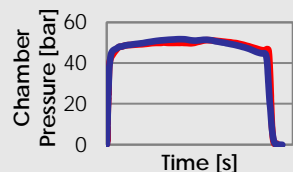


100 mm long rocket nozzle machined from a UHTCMC blank

Small nozzles for hybrid propellant rocket motors



Rocket nozzle after test showing near zero erosion in the throat and chamber pressure during the test



# ULTRA-HIGH TEMPERATURE CERAMIC MATRIX COMPOSITES

## PRODUCTS

UHTCMCs: special ceramic matrix composites with erosion/ablation resistance at  $T > 2000^{\circ}\text{C}$

- Features are highly customizable
- Complex shapes are possible
- Manufacturing time is of few weeks

## APPLICATIONS

Near zero erosion parts

- Nosecones, winglets
- Leading edge inserts
- Rocket nozzles

Other: high temp. shielding, braking systems

## MATERIALS COMPARISON

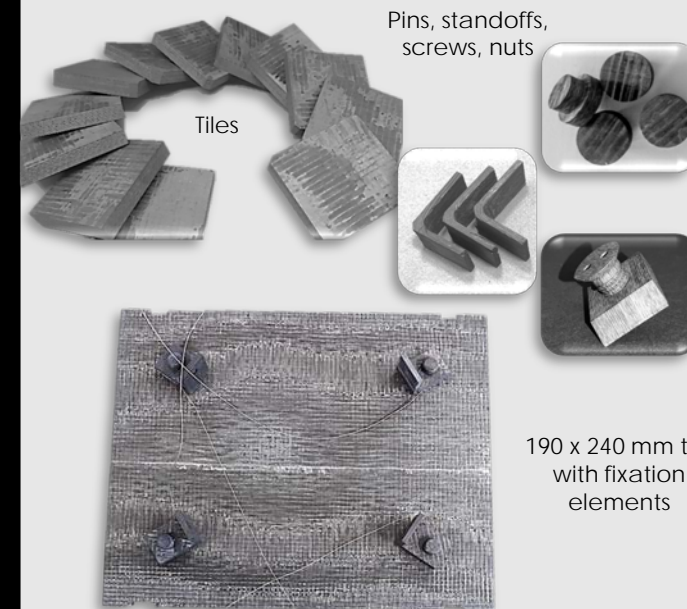
- CMC - Liquid Silicon Infiltration
- C/C - Chemical Vapor Infiltration
- METAL - Tungsten
- UHTCMC - Slurry Infiltration and Sintering



TPS Tiles and rocket motor inserts made of UHTCMCs have shown a stable performance above  $2000^{\circ}\text{C}$

Properties of UHTCMCs based on zirconium diboride ( $\text{ZrB}_2$ ) developed in the European project C3HARME

Property	Value	Comment
Fibre volume content, FVC (%)	30-60%	Tailored density/weight
Density ( $\text{kg}/\text{m}^3$ )	2.8-4.0	Typical porosity 5-10%, higher and lower values possible
RT Fracture toughness ( $\text{MPa}\cdot\sqrt{\text{m}}$ )	6-20	High damage tolerance observed, toughness tailored varying FVC and additives
CTE ( $10^{-6}\text{K}^{-1}$ ) (20,1300 $^{\circ}\text{C}$ )	4.8, 3.7	Low mismatch between axial and radial CTE, reduced thermal stress
Thermal conductivity ( $\text{W}/\text{m}\cdot\text{K}$ ) (20, 1500 $^{\circ}\text{C}$ )	110,140	Improved thermal shock resistance due to high thermal dissipation
Bending strength (MPa) (20-1800 $^{\circ}\text{C}$ )	200-700	This value increases with temperature



190 x 240 mm tile with fixation elements