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Silicon Nitride for optical applications

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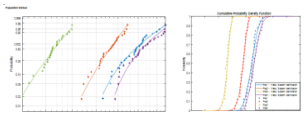
///Heritage: 2 decades of successful development and operation of extremely stable optical instruments with Si3N4

Materials	Density	Young's Modulus	Poisson's ratio	Max Stress (EN843-5)	Fracture toughness	CTE @ ambient	CTE @ 40 K	Thermal conductivity @ ambient	Specific heat capacity
	ρ(g/cm³)	E(GPa)	ν	MPa	MPa.m$^{0.5}$	10^{-6}/K	10^{-6}/K	K (W/mK)	C$_p$(J/kgK)
Si_3N_4	3.25	310	0.3	>630	7.5	1.4	ca 0.01	17 to 50	674

///**Mechanical behaviour**: thorough test campaigns demonstrated very good reproducibility of the Si_3N_4 manufacturing process, and reliability of the **sizing methodology** when associated to *sound characterization tests*.



///**Material optimization: increased thermal conductivity**

///Thermal conductivity, coefficient and thermal expansion have been confirmed on samples machined directly from scale 1 parts.

///Mechanical tests proved again a good reproducibility and homogeneity

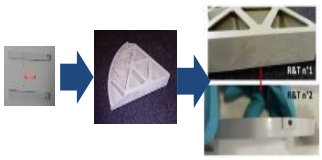
///**Complex shapes – brazing:**

///Allows to assemble structurally some parts, and thus to avoid adhesive bonds

Longer tubes

Complex assembly

///**Complex shapes - additive manufacturing**: a series of R&T activities allows to mature the process



Objective: qualify the Si_3N_4 additive manufacturing technology

/// Next steps: bring those technology improvements to a maturity level allowing new designs and enabling even more ambitious optical performance

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