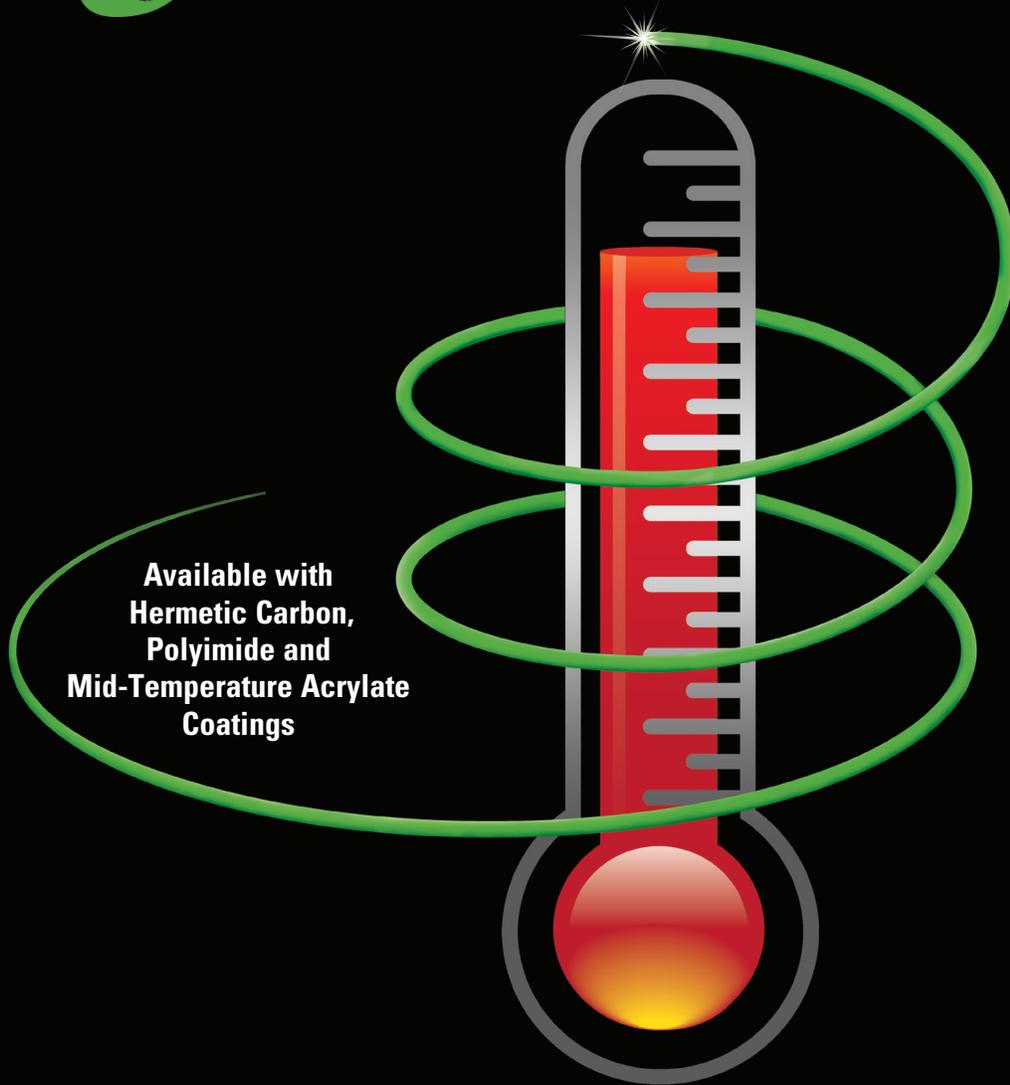


NUSENSOR™

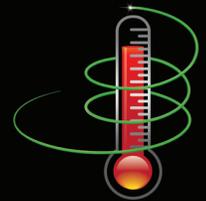


The Fiber is the **Sensor**

Optical Fibers for Sensing in Harsh Environments

NuSENSOR™ single mode and multimode fibers with superior thermal, chemical and hydrogen resistance enable distributed temperature and strain sensing in harsh environments. Our in-house pure silica core single mode and graded index multimode glass provide the highest immunity to hydrogen induced losses for the most demanding applications. Nuferr's proprietary carbon coating provides high levels of hermeticity to germanium doped fibers for temperatures up to 200°C and superior mechanical reliability. NuSENSOR™ fibers provide tight tolerance optical and geometric specifications measured at application critical wavelengths and are available with mid-temperature acrylate (150°C), silicone (200°C) and polyimide (300°C) coating for industry leading temperature and chemical resistance.





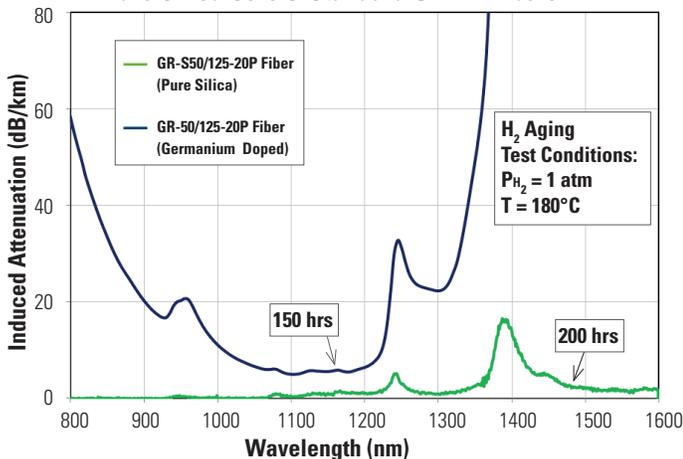
Optical Attributes

- Immune to the effects of H₂ ingress in typical sensing environments
- Minimal attenuation changes upon exposure to rated temperature
- Low intrinsic losses over critical wavelength ranges
- Same optical performance with various coatings

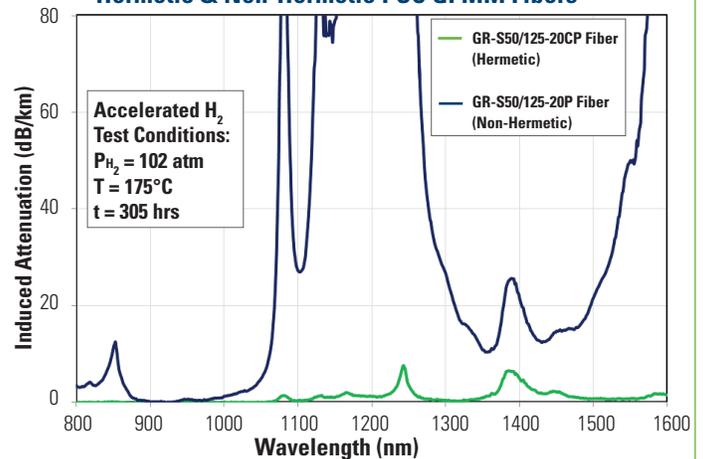
PRODUCT DESCRIPTION	COATINGS*				TYPICAL APPLICATIONS
	POLYIMIDE (P)	HERMETIC CARBON/POLYIMIDE (CP)	MID-TEMPERATURE ACRYLATE (MTA)	HERMETIC CARBON/MTA (CMTA)	
PSC Graded Index MM Fiber	GR-S50/125-20P	GR-S50/125-20CP	GR-S50/125-20MTA	GR-S50/125-20CMTA	DTS
Graded Index MM Fiber			GR-50/125-20MTA	GR-50/125-20CMTA	DTS
PSC Single-mode Fiber	S1310-P	S1310-CP	S1310-MTA	S1310-CMTA	DTSS
1310/1550 nm Bend Insensitive SM Fiber			R1310XB-MTA R1310-MTA	R1310XB-CMTA R1310-CMTA	DTSS & FBG Sensors
1550 nm Bend Insensitive SM Fiber	R1550XB-P	R1550XB-CP	R1550XB-MTA	R1550XB-CMTA	DTSS & FBG Sensors

*Silicone/PFA available upon request

Relative Performance of Pure Silica Core & Standard GI MM Fibers



Relative Performance of Hermetic & Non-Hermetic PSC GI MM Fibers



Mechanical Attributes

- Long lengths proof-tested to 100kpsi
- Excellent geometric tolerances for low signal artifact generation
- Negligible degradation in strength after exposure to H₂
- Hermetic Carbon enhances dynamic stress corrosion parameter
- Maintains strength and reliability after exposure to rated maximum temperatures
 - 150°C for Mid-Temperature Acrylate coating
 - 200°C for Silicone/PFA coating
 - 300°C for Polyimide coating

Applications

- Enhanced oil recovery – e.g. SAGD and CSS processes
- Hydrothermal well temperature measurements
- Oil reservoir engineering and flow optimization
- Raman distributed temperature sensing
- Brillouin distributed temperature & strain sensing
- Fiber Bragg Grating (FBG) based point and Fabry-Perot sensors

Benefits

- Superior resistance to H₂ induced attenuation
- Long unattended deployments or short cycle in-out applications
- Nufern's investment in R&D insures leading technologies are designed into every product