

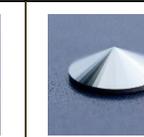
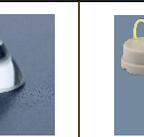
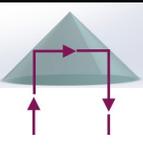
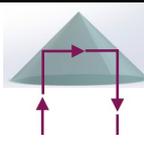
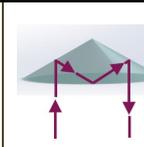
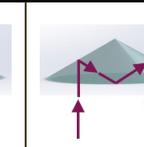
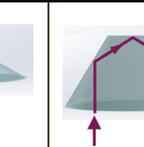
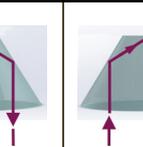
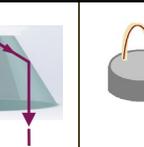
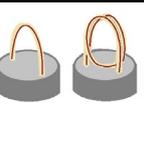


ATR Crystal Choice for Fiber Optic Probes

Attenuated Total Reflectance (ATR) fiber probes are used for real-time reaction monitoring in labor and industrial environments, mostly in mid-IR spectral range.

ATR spectroscopy works by directing an optical beam into an ATR crystal, where it is reflected off the internal surface, creating an evanescent wave. The evanescent wave interacts with the sample at the crystal surface, absorbing specific wavelengths, thus producing a spectrum that can be used for qualitative and quantitative analysis.

The choice of ATR crystals is critical for effective and reliable measurements. Several factors such as spectral and temperature ranges, mechanical properties, and chemical compatibility of the crystal material influence the choice of ATR crystals (see the Table):

	Diamond	Zinc Selenide	Silicon	Germanium	ZrO ₂	Sapphire		Fiber Loops		
										
Scheme										
Number of Reflections	2	2	2	2	3	3		Multiple		
Angle at Top	90°	90°	120°	120°	60°	60°		Not defined		
Angle of Incidence	45°	45°	30°	30°	60°	60°		Not defined		
ATR probe Spectral range	600-1900 cm ⁻¹	600-3100 cm ⁻¹	600-3100 cm ⁻¹	600-3100 cm ⁻¹	1550-9000 cm ⁻¹	400-2200 nm	400-2200 nm	180-1300 nm	6500-1550 cm ⁻¹	2500-600 cm ⁻¹
Fiber type in ATR probe	PIR	PIR	PIR	PIR	CIR	Silica NIR	Silica NIR	Silica UV	CIR	PIR
Refractive index n _i of ATR crystal	2.4	2.4	3.5	4	2.1	2.1	1.7	1.8	2.1	2.1
Benefits of the crystal	Very hard, chemically inert	Uniform transmission over the entire mid-IR spectral range	Relatively hard, good chemical resistance	Uniform transmission over the entire mid-IR spectral range, good chemical resistance	Hard and chemically inert	Hard and chemically inert		Improved sensitivity by adding more turns; disposable tips		
Disadvantage of the crystal	Absorption bands in the range 2600-1900 cm ⁻¹	Soft and fragile, limited chemical resistance	Absorption bands in the range below 1200 cm ⁻¹	Temperature sensitive; relatively soft	Limited transmission range	Limited transmission range		Soft and fragile, limited chemical resistance		
Chemical Resistance	Unlimited	pH 5-9	pH 0-10	pH 0-10	pH 0-12	pH 0-12		pH 5-9		
Limited Stability in	No limitations	Acids and alkalis, complexing agents	Strong alkalis, oxidizing and complexing agents	Strong alkalis, oxidizing and complexing agents	Strong alkalis	Strong alkalis		Acids & alkalis, complexing agents		



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