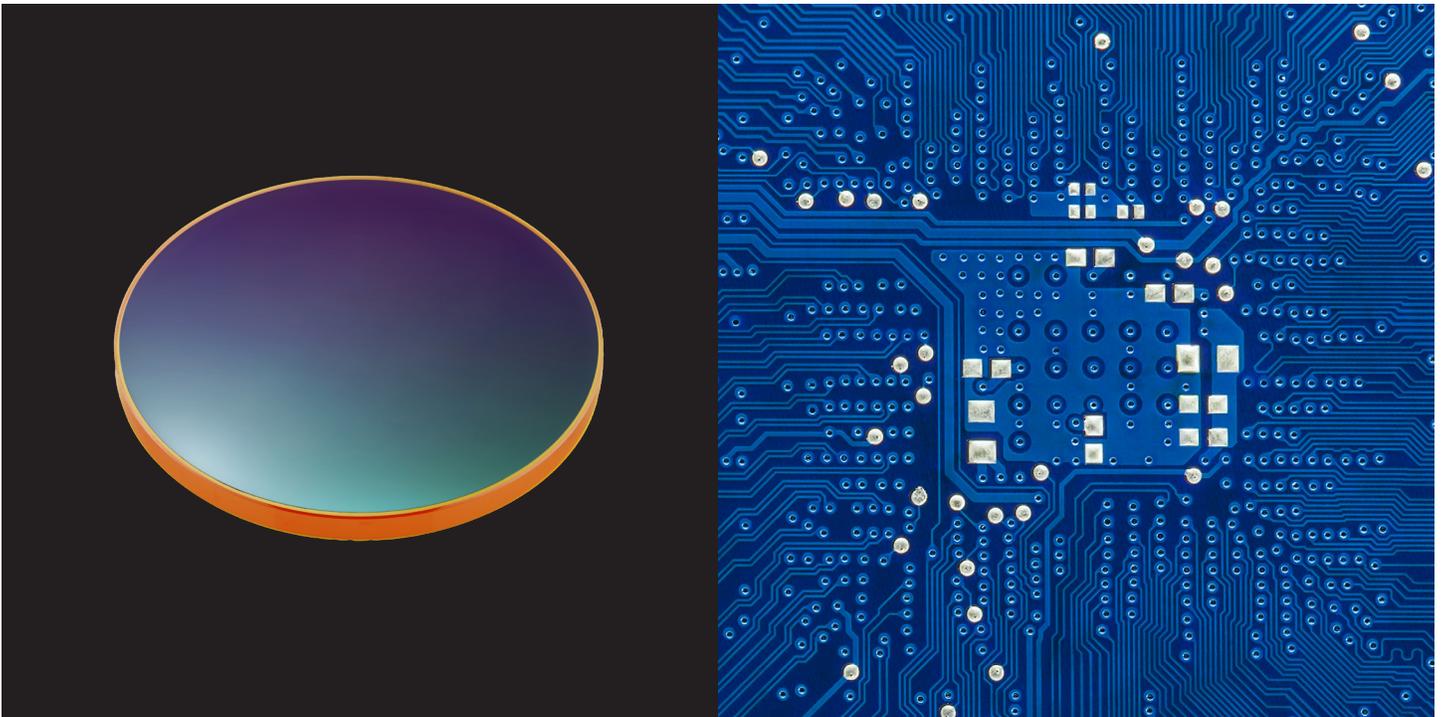


SPATTER AND DEBRIS RESISTANT COATINGS

Additional protection for debris windows in VIA drilling applications

Coherent has developed a coating specifically designed for spatter resistance debris windows in applications like via hole drilling. This coating uses the company's proprietary DOC(Diamond Over Coat) coating technology. The debris windows maintain high transmission and low reflection for good optical performance of the system, with an extra benefit of durability. Copper spatter and other debris will easily wipe off this coating compared to standard coatings in the same application. This greatly reduces the replacement frequency of debris windows in via hole drilling applications, lowering the operation costs. The high performance of the coating increases the overall performance of the laser drilling system.

This coating uses the proprietary DOC technology developed at Coherent. The coating combines a thin directly deposited chemical vapor deposition (CVD) diamond like carbon (DLC) coating with traditional physical vapor deposition (PVD) coatings in one process. What makes this technology compelling is that it offers the best attributes of high durability DLC coatings and the high optical performance of PVD coatings, while minimizing the disadvantages of either coating. The coating can be designed at any CO₂ laser wavelength.

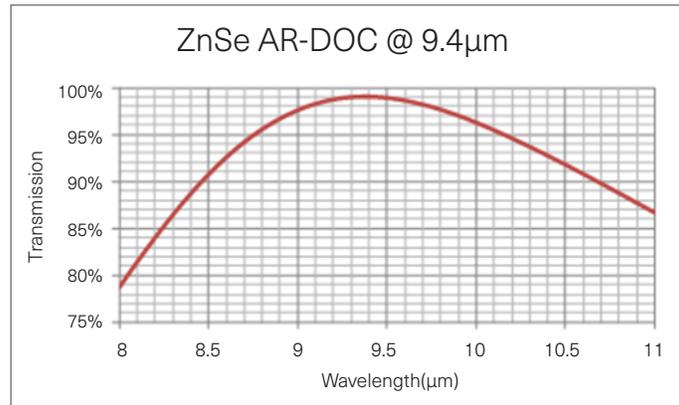


SPATTER AND DEBRIS RESISTANT COATINGS

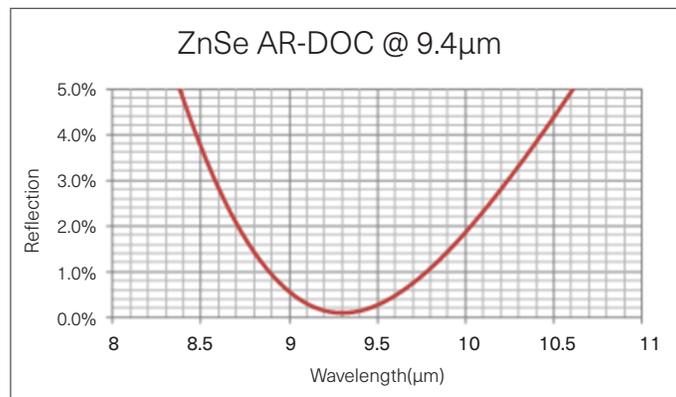
Performance @ 9.4 μm

Spatter resistant coating with DOC and AR on side 2 @ 9.4 μm	
Substrate material	ZnSe @ 9.4 μm
Transmission	97.5 %
Reflection	$\leq 0.5\%$ (0.2% typical)
Absorption	$< 0.9\%$ per surface transmission @ 9.4 μm

Graph #1- Transmission @ 9.4 μm



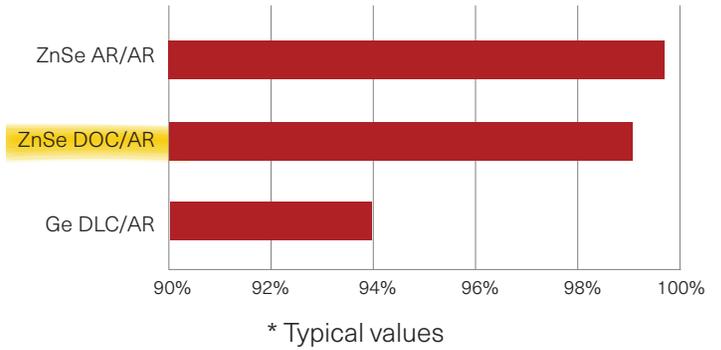
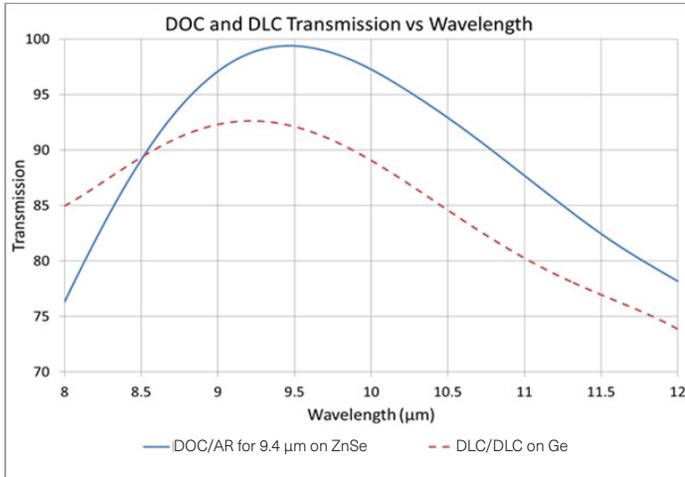
Graph #2 - Reflection @ 9.4 μm



SPATTER AND DEBRIS RESISTANT COATINGS

Transmission

Transmission has been designed to show improvement over the traditional Diamond-Like Coatings (DLC). The Graph #3 below shows the comparison of the improved transmittance over DLC. Graph #4 shows transmission when compared to traditional ZnSe and Germanium DLC.



Environmental Performance

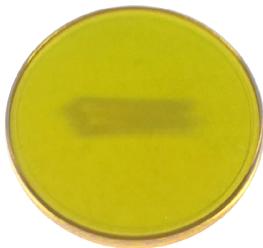
The coating is designed through the technology to meet the durability requirements according to both Mil-PRF-13803B and ISO 10110-7 for:

Adhesion, Humidity, Moderate Abrasion, Temperature and Solubility and Cleanability

Below demonstrates the superior durability over a standard AR coated substrate.

Durability

Standard AR@ 9.4 μm



500 strokes*

Spatter Resistant AR@ 9.4 μm



3,500 strokes*

* Coherent Internal Test

Felt pad saturated with 1.0 μm Al₂O₃ 65 kPa (0.66 Kg/cm²) 2.6 cm/sec