



## Advantages of Anti-Reflection (AR) Coated Silicon Windows in IR Gas Sensors

Infrared gas sensors use an infrared (IR) emitter (IR source) to generate IR radiation for detection of targeted gasses. Each gas absorbs the IR radiation at a different frequency or combination of frequencies. By detecting this absorption, a gas sensor can identify and quantify the presence of the targeted gas.

Many gasses that are targeted need to be prevented from direct contact with the IR source, because the gas may be flammable and could ignite with direct contact to the hot IR source, or the gas may contaminate or damage the IR source, or generate instability. To prevent direct contact, a protective window is placed between the source and the sample chamber where the target gas may be present.

It is essential that the protective window be able to transmit as much of the IR source output as possible. Some standard window materials used today are Sapphire ( $\text{Al}_2\text{O}_3$ ),  $\text{CaF}_2$ ,  $\text{BaF}_2$  and  $\text{ZnSe}$ . This document makes the case for using AR coated Si windows as an economical replacement for these other materials.

Each of the standard window materials is used for different reasons:

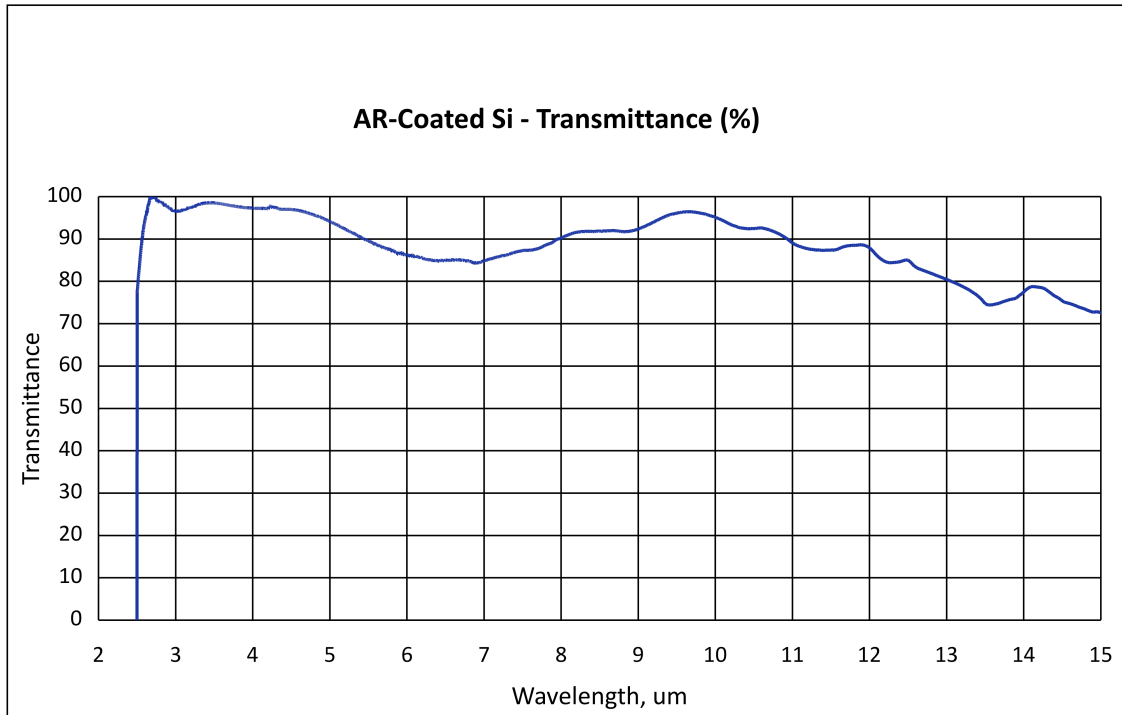
Material	Advantages/Limitations
Sapphire	Tough, scratch resistant, very transparent but cuts off at $6\mu\text{m}$
$\text{CaF}_2$	High transmission to $8\mu\text{m}$ , but is a water soluble crystal
$\text{BaF}_2$	High transmission to $11\mu\text{m}$ , but is affected by moisture (less than $\text{CaF}_2$ )
$\text{ZnSe}$	Tough, good to $22\mu\text{m}$ , but has lower transmittance
AR Silicon	Inexpensive, high transmission from $2.5\mu\text{m}$ , robust and not affected by moisture

Intex recommends AR coated Si for many applications, which will provide a less expensive and more robust solution for the user.

The following transmission spectrum of an AR coated silicon window shows the high level of transmittance over a wide spectral range, supporting the case for its use in many applications. As shown in the figure below, AR Coated Si has transmission higher greater than 85% in the region from  $2.5\mu\text{m}$  to  $>12\mu\text{m}$ , which covers the two main regions for infrared absorption gas sensors that are outside the main water absorption, i.e., 3-5  $\mu\text{m}$  and 7-12  $\mu\text{m}$ .



### Intex AR coated silicon window transmittance



Compared to other materials AR-Coated Si is very durable and does not require special attention regarding humidity, temperature and mechanical stress.

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