

Materion Electrofusion Window Coating Transmittance Curves

Beryllium windows are an excellent means of isolating vacuum and/or other environments from air while allowing x-rays to pass through unrestricted. When used with inert or totally dry environments, beryllium windows can last almost indefinitely. In fact, actively cooled beryllium windows installed at synchrotron facilities, where neither side is exposed to atmosphere, have been in continuous service for over 10 years. However, if windows are used in less controlled environments, corrosion can occur quickly. Exposure to moisture (such as atmospheric humidity) or chlorides and sulfates (found in non-deionized water), could lead to corrosion in a matter of hours. This corrosion may eventually result in a system vacuum leak.

Various anti-corrosion coatings are available to protect beryllium windows. The most common coatings used in x-ray applications are BR@127, BR@127NC, Parylene-N, BrushDLC™ (Diamond-Like Carbon), and DuraCoat™. Metal coatings, such as electroless nickel, aluminum, and gold are effective corrosion barriers, but may also inhibit x-ray transmittance. There are three main points to consider when choosing protective coatings for beryllium x-ray windows:

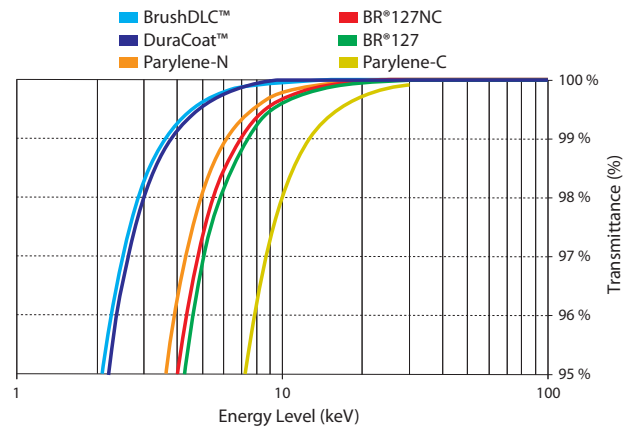
- Impact on x-ray transmittance
- Processing and operating temperatures
- Cost and lead-time

As depicted in the transmittance graph, all coatings have about the same x-ray transmittance in the 11 keV or higher energy range. However, consideration should also be given to the elements that comprise a coating. For example, BrushDLC consists of only carbon and hydrogen, while DuraCoat is made primarily from Boron, and BR-127 contains traces of heavier elements such as iron, chromium, and strontium, which could influence readings when analyzing for these specific elements. BR-127NC is essentially the same as BR-127, but without the chromium – critical for some detector applications.

High temperature bakeouts, subsequent joining processes, and operating temperatures are also important factors affecting coatings. Temperature Performance for the coatings is as follows:

Coating	Max Temp in Air	Max Temp in Vacuum
Parylene-N	110 °C (230 °F)	240 °C (460 °F)
Parylene-C	130 °C (270 °F)	260 °C (500 °F)
BR-127NC	150 °C (300 °F)	150 °C (300 °F)
BR-127	150 °C (300 °F)	150 °C (300 °F)
DuraCoat	350 °C (570 °F)	400 °C (750 °F)
BrushDLC	350 °C (570 °F)	400 °C (750 °F)

Transmittance of Various Coatings



One should also consider how using any specific coating will impact budgets and schedules. We offer BR-127 and BR-127NC as in-house processed coatings and available at a relatively low cost, with minimal impact on delivery. Parylene coatings add moderate cost and require an additional two weeks of lead time. BrushDLC provides a highly-transmissive coating with excellent thermal properties at a cost lower than Parylene-N but adds three weeks of lead time. The DuraCoat coating process, which offers the best x-ray transmittance and the highest available temperature endurance, is offered at a premium price commensurate with its superior performance level, and will add four weeks to our standard delivery.

Health & Safety Note:

Handling solid beryllium material poses no significant health risks. However, as with many other industrial materials—materials containing beryllium may pose a health risk, if and when recommended safe handling practices are not followed and adhered to. Inhalation of airborne beryllium may cause a serious lung disorder in susceptible individuals. The Occupational Safety and Health Administration (OSHA) have set mandatory limits on occupational respiratory exposures. Read and follow the guidance set forth in the Material Safety Data Sheet (MSDS) before working with beryllium. For additional information on safe handling practices or technical data on beryllium, contact Materion Electrofusion.

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BrushDLC is a trademark of Materion Brush Inc.
BR is a registered trademark of Cytec Engineered Materials
DuraCoat is a trademark of MOX-TEK Inc.

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