



# Beryllium X-Ray Window Coatings



## WHEN TO PROTECT Be WINDOWS

Beryllium windows provide an excellent way to isolate vacuum or other environments while allowing x-rays to pass through. When used in inert or totally dry environments, the window will last for a long time. In fact, actively-cooled beryllium windows in synchrotrons (with neither side exposed to the atmosphere) have been in continuous service for over 10 years. If the windows are not used in this type of controlled environment, however, corrosion may occur. This can result from exposure to moisture (such as atmospheric humidity) or chlorides or sulfates (found in water that has not been deionized), and the effects can sometimes be seen within a matter of hours. For thin windows, the corrosion may result in vacuum leaks.

## AVAILABILITY

Many coatings have been used to protect beryllium. Some of the more common ones used in x-ray applications are BR-127, parylene N, and DuraCoat™ sold by Moxtek. Some coatings, such as electroless nickel, aluminum, and gold, are effective at preventing corrosion but may inhibit x-ray transmittance. Other coatings, such as BerylCoat-D, have only minor impact on x-ray transmittance, but lack the durability for typical operating requirements.

## CONSIDERATIONS

There are three main points to bear in mind when choosing a coating to protect your beryllium x-ray window: the coating's impact on transmittance, the assembly's processing and operating temperatures, and the total cost and delivery time.

**Transmissivity.** As shown on the graph, all coatings have about the same effect on transmittance in the 1keV range or higher (beryllium's useful energy range). Attention should also be paid to the elements which comprise the coating, however. Parylene N, for example, is a polymer consisting of only carbon and hydrogen. DuraCoat™ is made entirely from elements lighter than carbon. BR-127 contains some traces of heavier elements such as iron, chromium, and strontium, which do not have a serious impact on transmittance, but could influence readings when analyzing specifically for those same elements.

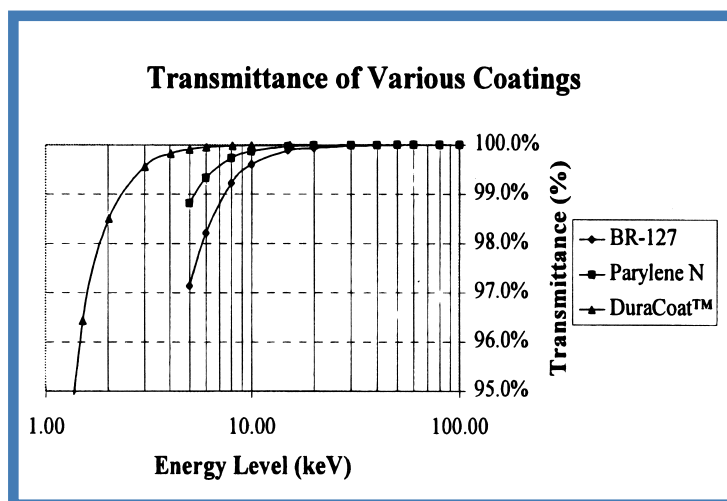
**Temperature.** Any bake-outs, subsequent joining processes, and operating temperatures are also important factors. Parylene N coating can be heated up to 125°C (260°F), BR-127 primer can go to 150°C (300°F), and DuraCoat™ can be used continuously at temperatures up to 500°C (930°F) in atmosphere.

**Cost and Delivery.** Last but not least, one may wish to consider the impact of using a coating on budget and schedule. BW-Electrofusion offers BR-127 epoxy primer as an in-house processed coating, available at a relatively low cost and with minimal impact on schedule. The Parylene N coating is relatively inexpensive and typically adds about 2 weeks to the lead time. The DuraCoat™ process, which offers good x-ray transmittance and the highest available temperature survivability, is offered at a premium price commensurate with its superior level of

performance and adds 1-2 weeks delivery.

## HEALTH AND SAFETY

Handling beryllium in solid form poses no special health risk. Like many industrial materials, beryllium-containing materials may pose a health risk if recommended safe handling practices are not followed. Inhalation of airborne beryllium may cause a serious lung disorder in susceptible individuals. The Occupational Safety and Health Administration (OSHA) has set mandatory limits on occupational respiratory exposures. Read and follow the guidance in the Material Safety Data Sheet (MSDS) before working with this material. For additional information on safe handling practices or technical data on beryllium, contact Brush Wellman Inc. - Electrofusion Products.



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