

SPACE PHOTONICS INC.

XBS-RDIG3-XK-40

X-Ray Blocking Epoxy System

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Introduction

The XBS (X-Ray Blocking and Scattering) concept was developed specifically in an effort to conceal critical components from adversaries. Its opaque nature requires that an attacker to attempt to gain information by utilizing non-intrusive imaging, such as X-Ray Microscopy, or to physically destroy the device in order to gain information, compromising its functionality. When properly implemented, XBS has been proven effective in obfuscation of critical technology components against X-Ray and Terahertz Microscopy imaging attempts; this has been verified by in-house and independent laboratories. Obfuscation is accomplished by implementing a proprietary composite material that is effective in blocking and scattering incident radiation; thus, the radiation either does not reach the detector of the imaging equipment, or it has been scattered in a way that sufficiently distorts the image. Space Photonics is happy to tailor novel formulations for your unique application.

XBS-RDIG3-XK-40 is intended for coating, Glob-top, and Cavity fill in applications where protection of critical technology is desired.

Product Description

XBS-RDIG3-XK-40 is a two part epoxy for high performance potting, sealing, coating and bonding featuring exceptionally high thermal conductivity, excellent electrical insulation properties and NASA low outgassing approval. It will cure at room temperature or more rapidly at elevated Temperatures. Other attractive properties

include superb dimensional stability and superior physical strength properties. Its low viscosity and excellent flow

characteristics make it an ideal thermally conductive potting epoxy. XBS-RDIG3-XK-40 is also an excellent adhesive/sealant, forming durable, rigid bonds that are resistant to thermal cycling and chemicals including water, oils, etc. over the wide temperature range of -60°F to 250°F. The coefficient of thermal expansion is desirably low.

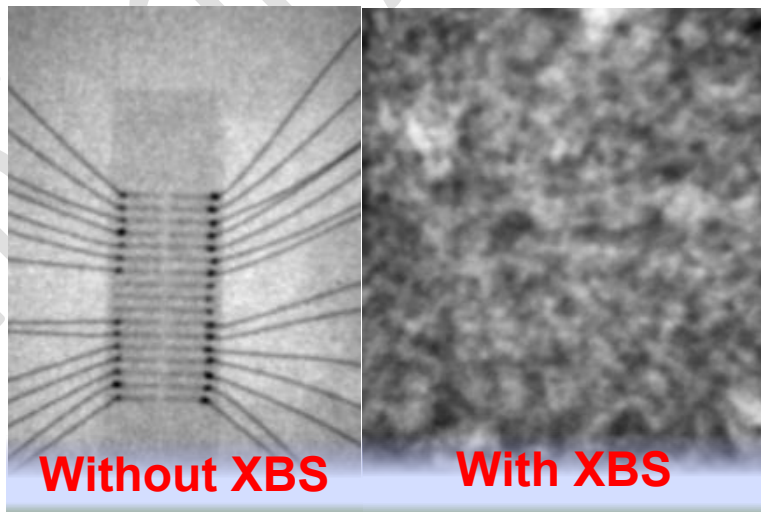


Figure 1. Image illustrating the XBS materials ability to block and scatter X-ray in order to keep the protected device forensically indiscernible. On the left, one can see the device imaged without the protection of XBS. The right image shows the same device protected with XBS.

XBS-RDIG3-XK-40 is ideally suited for use in applications where thermal conductivity, electrical isolation and low outgassing properties are required, making it well suited to high vacuum environments. Also, XBS-RDIG3-XK-40 meets NASA low outgassing requirements. XBS-RDIG3-XK-40 is well suited to aerospace, electronic, optical, fiber-optic and OEM applications.

Product Advantages

- Opaque in all known spectrums between Terahertz and X-Ray
- Superior dimensional stability; Low CTE
- Excellent Thermal Conductivity
- Versatile cure schedules
- Low viscosity, ideal for cavity-fill and BGA under-fill applications
- Exceptionally high compressive strength
- Good electrical insulation properties
- Resistant to a wide range of chemicals
- Meets NASA low outgassing specifications

Typical Product Properties

	Part A	Part B	Mixed	With XBS	Units	Conditions
Mixture Ratio	10	1	*	*	*	*
Viscosity	18,000	400	16,000	-	cps	*
Working Life	*	*	45	45	Minutes	*
Tensile Strength	*	*	> 6,000	-	PSI	*
Bone Shear Strength	*	*	>900	-	PSI	Al/Al
Compressive Strength	*	*	>15,000	-	PSI	*
Shore D Hardness	*	*	>90	-	*	*
Coefficient of Thermal Expansion	*	*	20 to 25	-	E-6 in/in/°C	*
Volume Resistivity	*	*	4.80E+14	-	Ω-cm	*
Dielectric Constant	*	*	6.4	-	*	60 Hz
Dielectric Strength	*	*	420	-	volts/mil	*
Serviceable Temperature Range	*	*	-60 to 250	-60 to 250	°F	*

*All properties determined at standard temperature and pressure, unless otherwise noted.

- Shelf life of 6 months at room temperature in unopened original containers.
- Parts A and B available in pints, quarts, gallons, or syringe dispensers.

Preparation of Adhesive and Bonding Surfaces

XBS-RDIG3-XK-40 is prepared for use by thoroughly mixing part A with part B in a ten-to-one mix ratio by weight. Mixing should be done slowly to avoid entrapping air. Simply mix parts A and B in a ten-to-one weight ratio and stir until color is uniform. The working life of a mixed 100 gm batch is about 30-45 minutes. It can be substantially lengthened by using shallower mixing vessels or mixing smaller batches. All bonding surfaces should be carefully cleaned, degreased and dried to obtain maximum bond

strength. When bonding to metal surfaces, chemical etching should be employed when the bonded joints are to exhibit optimal environmental durability. Non-porous surfaces should be roughened with sandpaper or emery paper for hard materials.

Adhesive Application and Assembly

XBS-RDIG3-XK-40 can be conveniently applied with a spatula, knife, trowel, brush, syringe, etc. Enough mixed adhesive should be applied to obtain a final adhesive bond line thickness of 4-6 mils thick or by coating the two surfaces, each with a 2-3 mil thick layer of adhesive. Porous surfaces may require somewhat more adhesive to fill the voids than non-porous ones. Thicker glue lines do not increase the strength of a joint but do not necessarily give adverse results, as the XBS-RDIG3-XK-40 system does not contain any volatiles. The parts to be bonded should then be pressed together with enough pressure to maintain intimate contact during cure. In casting applications, it may be necessary to vacuum degas in order to remove the relatively few air bubbles that may have been formed when mixing.

Cure Schedule

XBS-RDIG3-XK-40 can be cured at room temperature or at elevated temperatures as desired. At room temperature, XBS-RDIG3-XK-40 cures within 48-72 hours. Faster cures can be realized at elevated temperatures, e.g. 2-3 hours at 200°F. Remove any excess adhesive promptly before it hardens with a spatula. Then wipe with a rag or solvent such as MEK, toluene or acetone. Thinner sections of epoxy will tend to have a slower rate of cure.

Handling and Storage

All epoxy resins should be used with good ventilation and skin contact should be avoided. For safe handling details, please consult the product MSDS. Optimum storage is at or below 75°F in closed containers. No special storage conditions are necessary. Containers should, however, be kept closed when not in use to avoid contamination. Cleanup of spills and equipment is readily achieved with aromatic or ketone solvents employing proper precautions of ventilation and flammability.

Notice: Space Photonics believes the information on the data sheets is reliable and accurate as is technical advice provided by the company. Space Photonics makes no warranties, expressed or implied, regarding the accuracy of the information, and assumes no liability regarding the handling and use of this product.

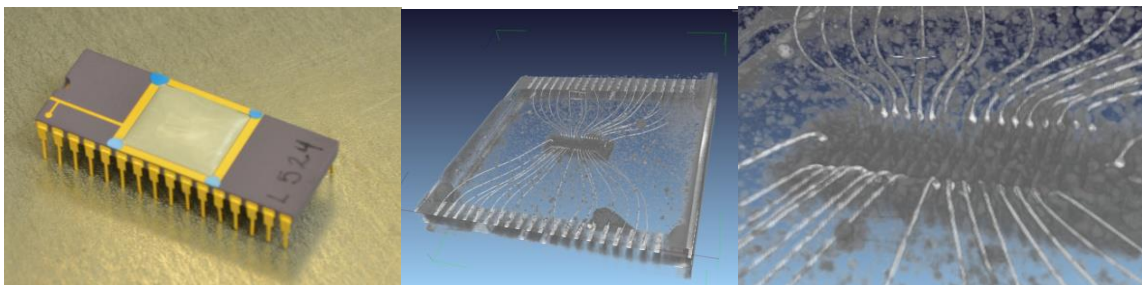


Figure 2. Computed tomography (CT) images of device protected by XBS. Although large features, such as the gold wire bonds, are discernible, the circuitry of the silicon device is obfuscated.