

# **THE PERFORMANCE PROPERTIES AND ENVIRONMENTAL DURABILITY OF ELECTRICALLY CONDUCTIVE STRUCTURAL ADHESIVES**

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## **ABSTRACT**

Many aerospace applications require electrically conducting polymer-based composites for static discharge, electromagnetic interference shielding, and electrical bonding (e.g. lightning strike protection). Although existing composite structural components are conductive, the conductive pathway between joined parts is often not robust enough to satisfy these requirements. A material that provides good electrical bonding between all joints is required to assist in controlling and shielding against electrical effects. Typical electrically conductive adhesives are highly loaded (>50wt%) with conductive fillers which provides the necessary conductivity levels, but dramatically reduces the mechanical properties compared to the base polymer. As part of Luna's ongoing work to developed an optimized series of conductive structural adhesives, updated performance properties are presented, and the environmental durability of the adhesives are reviewed.

## **1. INTRODUCTION**

Structural adhesives are used widely in the aerospace industry due to their excellent strength, affordability, and ease of application. For example, Hysol<sup>®</sup> EA 9394 is easy to mix by hand and apply, and it delivers lap shear strengths greater than 27 MPa on phosphoric acid anodized and primed aluminum. As outer mold line conductivity becomes more of a priority, however, the strength of a structural adhesive needs to be complemented by the conductivity of an electrical adhesive such as Eccobond 56C. Structural adhesives are essentially insulating, while the high conductivity of electrical adhesives provides sufficient protection from electrostatic discharge, electromagnetic interference, and even lightning strikes.

Through careful selection of resins, fillers, and processing techniques, Luna has developed adhesives that meet the aforementioned needs. Custom filler packages were processed into a two component (2K) epoxy resin system suitable for aerospace applications to create a family of metal and carbon filled adhesives with lap shear strengths comparable to Hysol<sup>®</sup> EA 9394, but with the addition of milli-ohm bond resistances.