



G-10 and G-11 vs. FR-4 and FR-5 Brominated Materials

Brominated epoxy resin systems used in FR-4 and FR-5 materials were originally created to stop or retard potential fire hazards caused by overheating or electrical failure resulting in arcing. FR-4 and FR-5 materials came into existence, and are used, for printed circuit boards. Their flame retardant properties are beneficial when used in home appliances, TVs, etc.

The science behind these flame retardant properties is:

There are bromine atoms attached to the aromatic ring of the polymer backbone in the range of 19 to 22% by weight. When the material is overheated, or there is an arc present, the Br atom is separated from the aromatic ring, allowing it to combine with hydrogen from any source. The formation of HBr is an effective flame retardant. This phenomenon may also occur when the material encounters corona discharge.

Unfortunately, HBr is extremely chemically active and can be highly corrosive. While HBr is very effective at flame retardation, the resulting white smoke (HBr) can corrode copper, standard grade mild and stainless steels and most other metals.

Additionally, in some applications where elevated temperatures inherently exist, there is an indication that HBr may create an environment conducive to additional arcing beyond the likelihood already present in the application.

In 1998 NEMA updated their standards to differentiate G-10 and G-11 from FR-4 and FR-5. This update specifically excludes the use of bromine or other halogen flame retardants in the production of G-10 or G-11.

Design engineers should weigh all factors when specifying epoxy based composites in their applications. As always if there are additional questions, please see our website for our contact information at www.norplex-micarta.com.