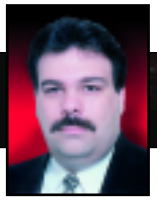

FromTheLab

By BobNeves

The Halogen-Free Diet

Halogens have become frightening things. If you believe the rhetoric, they're a real nuisance to the universe. There are those who whisper to us in our sleep that Halogens are evil and will eventually kill us all. They say that Halogens could be the ones that hide under your bed at night and steal all those pens and socks that you can never find.

Exaggeration? Yes, but I now have your attention. We also see this type of hysteria reflected in the Carbohydrate-Free movement. The venerable Mr. Atkins said that Carbohydrates are the root of all "fat" evil, and now every manufacturer has a low carbohydrate or carb-free product. Even Coca-Cola has broken down and gone low-carb, as well as beer makers and almost every other product you can imagine. Our TVs are filled with advertisements for low-carb products; I even saw a TV advertisement for a low-carb dog food.

When I went to school—albeit eons ago—I remember that carbohydrates were an important and necessary part of life. How could my teachers have been so wrong? I have not followed the low-carb fad, and those of you that know me know that I have never met a carbohydrate I didn't like.

This same "get it out of our lives" frenzy is now apparent for the poor halogens. Although some halogenated products have proven hazardous, many are actually important parts of our daily lives. What are halogens you might ask? Halogenated compounds are materials that use elements like Fluorine, Chlorine, Bromine and Iodine in their chemical structure.

Halogens are the backbone of most sedatives and anesthetics used. They can be found in salt for food, PVC pipes, and they allow your refrigerator and air conditioner to cool. Halogenated Teflon® coatings for your pots and pans makes sure dinner doesn't stick. Bromine is also used in water treatment facilities, crop pesticides, pharmaceuticals and gasoline additives.

Halogens have proven themselves as good flame-retardants, and are widely used in plastic- and epoxy-based polymeric systems found in just about any household electronic item including stereos, televisions, computers and VCRs. Many products using halogenated flame-retardants self-extinguish (UL V-0) when the source of the flame is removed. The main halogen used in the PCB industry is bromine, with tetrabrominated bisphenol A (TBBPA or T-Brom) being the most abundantly used material in laminate, coatings and components. When considering the death of halogen remember that countless lives have been saved due to the use of TBBPA as a flame-retardant.

Unfortunately, there has been a lot of publicity about brominated compounds being found in mother's breast milk. Two types of brominated flame retardants, polybrominated diphenyl ethers (PBDEs), and polybrominated biphenyls (PBBs) have been the culprits for this serious health issue, and are examples of "bad" halogenated compounds. These two groups of "non-electronics industry" flame-retardants are what added significant misconceptions to the "halogen-free" movement. However, these brominated compounds have not been used in the PCB industry, and TBBPA itself has been determined not to have the metabolic pathway into the body when used in laminate materials.

Never mind. The replacements? Popular alternative flame-retardants contain Phosphorous or Boron bearing compounds, Aluminum Trihydrate, Magnesium Hydroxide, or other water-based, inorganic fillers. Certain Organo Phosphorous compounds used as flame-retardants (like certain bug killers) inhibit acetyl cholinesterase production in the human body that in turn affects the central nervous system.

No matter which system is chosen as the replacement, several process considerations must be addressed, such as plating ability, drilling parameters and chemistry compatibility. The halogen-free systems developed to this point have decreased thermal stability, which is especially important considering lead-free processes. These effects must be communicated to the board manufacturer, and the manufacturer must recognize that the new materials will not work with existing processes.

Although halogens can be found in solder masks, it is the laminate material that has gotten most of the focus. Almost all laminate suppliers have a halogen-free variety. But the "free" word is misleading. Even after replacing the bromine in the resin system with a non-halogen alternative, virtually all non-brominated epoxy resins contain small amounts of residual halogen containing compounds produced during the epoxy resin's manufacturing process. It is virtually impossible to get rid of all the halogens. Thus the materials are really "low halogen," or "halogen light" varieties. These halogens mostly are in the form of chlorine containing organic and inorganic compounds. The IEC standard for Laminate Material has defined "halogen free" as materials containing less than 900 ppm for chlorine and bromine individually, and less than 1500 ppm for the total halogen content.

IPC has created a Web site on the issues surrounding halogen free. I encourage you to take a close look at the technical information contained on halogenfree.ipc.org. There is a position paper that details many of the issues surrounding halogens in laminate materials well worth reading. Read it and make your own decisions on the fate of our universe and halogens. **CT**

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