

Safety Notes on Using PTFE Composite Materials

Minimal hazard in use is readily assured. Strict observation of the following suggestions should minimize hazards in use of RT/duroid® and RO3000® series® laminates for microwave applications. Users are urged to become familiar with the information covered in the attached bibliography. The two processing areas where hazards particular to all PTFE composite materials are most likely to be encountered are machining operations and bonding operations at elevated temperatures.

Machining:

1. Chips and particles tend to become electrostatically charged with the possibility of transfer by hands or clothing onto smoking materials. Particles in smoking materials can encounter temperatures in excess of 1600°C and impart "fume fever" symptoms to the smoker. **NO SMOKING** should be permitted in areas where machining is being done. Care should be taken to avoid carrying such particles into other areas where smoking may be done. The practice of washing the hands and changing to other clothing after machining PTFE composites is advised.
2. Scrap should be disposed of by landfill in accordance with local, state and federal regulations. To avoid toxic and corrosive fumes do not incinerate. The practice of placing all such scrap into bags or boxes clearly marked. **"DO NOT INCINERATE"** is strongly recommended.
3. **VENTILATE** if high temperatures are generated by machining conditions. Excessive heating to the point of generation of fumes or smoke is a warning of poor machining practice leading to sub-standard work piece quality.

Bonding:

While temperatures usually used for bonding multilayer boards are below 300°C, there is the possibility of a control malfunction or set temperature error. It is good practice to ventilate the press area as a precaution in anticipation of such an event.

Discussion

RT/duroid and RO3000 series microwave laminates are composed of inert glass microfiber or inert ceramic filler imbedded in a matrix of polytetrafluoroethylene (PTFE). PTFE is exceptional among plastic materials for its chemical inertness, insolubility, non-flammability, non-toxicity and long term resistance to thermal degradation. It is such a stable polymer that the tendency may be to assume that no safety precautions at all are needed.

At temperatures of 380°C and above, thermal decomposition of PTFE becomes measurable. The decomposition and the toxicity of decomposition products has been studied and reported in detail ¹⁻²¹. Good summary bulletins are available from the polymer producers ^{22,23}. There are no reported incidents of which we are aware of permanent human injury from fumes in normal processing.

It is thought that particulate decomposition products, if inhaled, are the cause of a syndrome of influenza-like features described as "polymer fume fever". Symptoms arise after a latent period of a few hours. The symptoms subside within 24 to 48 hours with no after effects.

PTFE has a limiting oxygen index of 95 and resists auto ignition to very high temperatures: 575°C in air, 512°C in oxygen. The toxicity of products from very high temperature decomposition are more dangerous. The fumes and smoke from a fire containing PTFE can be highly toxic and corrosive.

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