

**The Third Green and Sustainable Chemistry Award**  
Awarded by the Minister of the Environment

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*Development of Environmentally Friendly Self-Extinguishing Epoxy Resin Compound  
and Its Application to Electronic Devices*

Epoxy resin compounds are widely used as integrated circuit (IC) molding compounds and insulating materials for printed wiring boards (PWBs), because of their beneficial properties such as insulation, adhesion and heat resistance. As a fire prevention measure, epoxy resin compounds generally include flame retardants, most commonly in the form of halogen compounds. There is subjected to be a problem with such halogen compounds, however ; during burning, the compounds sometimes generate toxic substances, including dioxin derivatives that pose a serious threat to the environment. Therefore, the development of highly safe and practical flame-retarding epoxy resin compounds and their application to IC molding compounds and PWBs are strongly required.

Based on a concept of green and sustainable chemistry, a new self-extinguishing epoxy resin compound that is free of halogen and phosphorous flame retardants and without a high volume of inorganic filler has been developed.

This significant improvement in flame retardancy of the epoxy resin compound was the result of a unique flame-retarding mechanism; after ignition, the new compound immediately forms stable foam layer that retards heat transfer during combustion and then extinguishes itself. This new compound, consisting of phenol aralkyl-type epoxy resin and hardener, both of which include aromatic groups in their main chains, achieves high practical properties such as humidity resistance and heat resistance in addition to flame retardancy

An environmentally friendly IC molding compound, free of flame retardants with modified filler content and other additives in the self-extinguishing epoxy resin compound, has been developed. This molding compound shows highly environmental safety and excellent practical characteristic including top level of soldering heat resistance. Therefore, the molding compound is widely used around the world and has 30% share of world market for green molding compounds.

A glass epoxy laminate for PWB has been practically developed by simultaneously using the new epoxy resin compound and a safe metal hydroxide such as aluminum hydroxide, satisfying high flame retardancy and practical requirements. This new PWB will be applied to environmentally friendly electronic instruments near future by NEC.