

Recycling and Recovery of Plastics Containing Brominated Flame Retardants



FACT SHEET

Combining fire safety performance and recyclability

Brominated flame retardants (BFRs) are necessary for certain plastics to meet high fire safety standards. The long experience of the use of BFRs and their continued evolution and use, means that plastics containing brominated flame retardants will inevitably be part of the waste flow, in particular that of Waste Electronic and Electrical Equipment (WEEE).



Fire test, EU market TV (MPPA Leipzig, Germany, 1998).

The presence of plastics containing brominated flame retardants in the waste stream provides economic actors with a wide variety of environmentally sound and economically feasible options for waste recovery and recycling, instead of simple disposal.

The plastics of choice for recycling on the market today

The electrical appliance in the photo below may look like an ordinary state-of-the-art photocopier. However, unlike other photocopiers, 30% of its outer plastics housing is made of recycled plastic containing BFRs. This copier was launched on the Japanese market in Spring 2000.



Photocopier with 30% recycled plastic (Ricoh, Japan).

The plastic used in this copier is particularly suited to recycling. ABS requires brominated flame retardants to be added in order to meet the high fire safety standards of UL 5VA and 5VB. Copier manufacturers and their plastics suppliers have found that certain ABS/BFR combinations (in this case brominated epoxies or oligomers) have clear advantages in terms of recyclability. This is basically down to the stability of the brominated flame retardants in the recycling process. For instance, only with the ABS/BFR plastic does the flame retardancy of the polymer maintain the UL 5VA level, thus foregoing the need to add more flame retardants after recycling. This provides clear economic as well as environmental benefits.

An integral part of today's WEEE metals recycling

Printed circuit boards represent a particular challenge in terms of fire safety and the brominated flame retardant TBBPA protects 96% of the printed circuit board market.



Circuit boards to be recycled.

The vast majority of printed circuit boards are recycled for the metals they contain. The printed circuit board plastic provides a proportion of the necessary heat for the recycling process in the major printed circuit board recycling processes.



Gold recycled from printed circuit boards (Boliden, Sweden).

Recycling the bromine from WEEE pilot project

The technology for recycling bromine from plastics waste containing brominated flame retardants exists and can be applied in a cost-effective manner. A number of products could be made from the recycled bromine, including photochemicals, swimming pool disinfectants and, of course, flame retardants. BSEF member companies are working in partnership with energy technology companies with a view to bringing this project to fruition by 2004. This will enable the bromine loop to be closed and will assist in the sustainable production of brominated products.

Conclusion

The European Union, at the time of writing, is deciding upon the details of its future legislation on Waste Electrical & Electronic Equipment. The bromine industry is undertaking the research necessary to ensure that industry is best placed to handle the bromine stream in E & E waste to comply with this future legislation, whatever its eventual requirements.

Suggested further reading:

Takateru Imai, Techno Polymer, "Comparative recyclability of flame retarded plastics", (awaiting publication):

demonstrates superior recycling performance of ABS with a brominated epoxy flame retardant compared to various PC-ABS and PC/HIPS grades with non brominated flame retardants.

"Rönnskär, World class recycler", Boliden Mineral, 2000:

summarises Boliden's metals recycling activities, which do not require pre-separation of electronic waste.

Hamm et. al., "Determination of polybrominated diphenyl ethers and PBDD/Fs during recycling of high impact polystyrene containing decabromodiphenyl ether and antimony oxide", (awaiting publication):

demonstrates full compliance with German chemicals legislation of recycling HIPS with DecaBDE flame retardant.

University of Erlangen, Recycling of Thermoplastic Polymers containing Brominated Flame Retardants, August 1999:

demonstrates full compliance with German worker safety legislation of recycling HIPS with DecaBDE flame retardant.

Swedish National Testing Institute (SP), LCA Study of Flame Retardants in TV Enclosures, February 2000:

demonstrates full compliance with fire safety standards after aged material was recycled.

Multek, Comparison of halogen-free base materials, EIPC Conference, 5 October 2000:

indicates potential hazardous classification of those printed circuit board laminates using alternatives to the brominated flame retardant TBBPA.

Jurgen Vehlow, Electrical and electronic plastics waste co-combustion, February 1997:

demonstrates energy recovery advantages of plastics and the enhanced recyclability of the recovery process bottom ashes. (e.g. in road construction) thanks to the presence of chlorine and bromine in WEEE.

Tokyo Technical workshop papers, November 1999:

summarises methods of handling bromine in industrial combustion processes as part of the feedstock.

Dr.ir. H. Boerrigter, "Implementation of thermal processes for feedstock recycling of bromine and antimony, with energy recovery, from plastics waste of electrical and electronic equipment (WEEE)", July 2000:

demonstrates economic and technical viability of various process options for feedstock recycling.





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For further information on recycling and recovery
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