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PVC Alternative Projects

Halogens, and more specifically Bromine (Br) used as a flame retardant (BFRs) and Chlorine (Cl) used as a flame retardant and Polyvinyl Chloride (PVC), have been alleged to have a negative toxicological impact on human health and the environment in some studies. As a precautionary principle, many electronic manufacturers have publically adopted initiatives to phase out the use of BFRs and PVC to potentially minimize the impact on the environment.

The transition toward halogen free in electronics is dependent on commodity types. Certain commodities have drop-in replacement substances while others are challenged with performance, cost and availability. One type of commodity the industry continues to struggle with is PVC replacement on flexible cables and wires. Due to performance and safety requirements, the cable industry is challenged to find a robust and cost effective PVC replacement.

To better understand if PVC alternatives are holistically more environmentally preferable than traditional PVC, a Life Cycle Assessment (LCA) is needed to assess other environmentally impactful attributes.

As a result to address industry wide interest on PVC alternatives, two projects were initiated by iNEMI and HDPUG to address these areas. Both of these projects were chaired by Dell Inc.

Project #1: iNEMI PVC Alternatives Life Cycle Assessment (LCA) Project

The objective of this project is to gain a better understanding of LCA results from PVC Alternative materials versus traditional PVC materials in cables applications. The screening LCA results for three different resins evaluated for use in US desktop power cords yielded similar LCA results in all of the impact categories with the exception of Global Warming Potential (GWP). The available LCA data suggests that existing PVC bio-based plasticizer cables had the lowest GWP from a cable manufacturing perspective, while the non-halogen based cable had more than three times the GWP impact in comparison to the PVC with bio-based plasticizer cable. It is important to note that the overall GWP for the production phase of power cord is very small (approx. 0.3%) compared with the GWP for a full desktop PC system.

In addition, the project team also surveyed a number of recyclers representing practices in all major global regions to understand the end-of-life (EOL) fate of power cords. The survey indicated that PC power cords are primarily treated for controlled copper recovery by either mechanical separation or controlled incineration to retrieve the valuable copper from the EOL cords. After mechanical separation a significant portion of power cord jacket material is incinerated under controlled conditions. The recovered plastics are often not separated by type, and where they are separated, the separation is not highly effective. The most difficult estimate proved to be the percent of waste PC power cords disposed of by uncontrolled incineration and follow-up work is being considered in this space.

For more information on this project, please visit www.inemi.org

Project #2: HDPUG Halogen Free Cables Project

The objective of this project is to characterize the electrical, mechanical, performance and manufacturability of BFR/PVC-free flexible cables and compare these characteristics with traditional PVC cables.

As part of this project, HDP is focused on five different types of cables commonly used in electronics: ribbon (internal), HDMI (High Definition Multimedia Interface; external), mini SAS (Serial Attached SCSI; SCSI Small Computer System Interface) , desktop power cords for the European Union, and notebook power cord sets for the United States. More than 50 halogen-free compounds were thoroughly investigated. Of these, 40 halogen-free compounds were successfully manufactured into cables. While these cables may or may not satisfy all baseline requirements of this project, the consortium's results are an encouraging step toward designing halogen-free, flame-retardant compounds.

It should also be noted that all HFR free compounds are not the same. All have unique characteristics and properties. At this point in time, there is no drop- replacement material for PVC in cables. HFR free cables today do not meet fire safety requirements in many geos. And customer expectations will need to change for cables such as power cords with respect to flexibility and ductility.

There is additional work required to reach the stage where specific HFR Free compounds are available and are proven to meet the electrical, mechanical, and safety performance requirements of cable applications. It is expected that desktop and notebook power cords will be among the first to meet the specification needs in the future.

For more information, please visit www.hdpug.org

Summary & Position

The iNEMI LCA study was particularly useful in the assessment of how the industry and recyclers are treating End of Life cables. The vast majority of PVC cables are handled responsibly and that trend will likely grow, not shrink, with the rising value of copper in that marketplace. And purely looked at as an individual system component, the overall LCA analysis came to the conclusion that alternative materials to PVC have a 3X Green House Gas performance that is worse than PVC materials. Additionally, alternatives are not typically available today in volumes and at price points that support the market demands of the PC and laptop business. Thus, the environmental impact of PVC versus the alternatives, overall, is very small.

From the HDPUG electrical and mechanical study we concluded that the performance of certain PVC alternative materials has improved. More application-by-application study is required in the future. There is no one drop-in alternative material set that meets the needs of all cable/cord applications. Each company must perform application specific analysis to guide individual product and market decisions.

Our special thanks to Dell Incorporated for leading these two important studies.