Freeze-Flame Nano

Capstone Design Project

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Executive Summary

KVTV has developed a new phosphorus based flame retardant thermoplastic named Freeze Flame Nano. This flame retardant has been developed to revolutionize the building construction industry. Great Lakes Chemical, the former producer of pent-bromodiphenyl ether and octa-bromodiphenyl ether has recently stopped production of these two leading flame retardants. These brominated flame retardants have shown increased signs of bioaccumulation. Likewise, these retardants have banned because of their toxic byproducts: dioxins and furans.

Freeze Flame Nano has none of the functional groups that cause toxins to exist in the environment. KVTV's product is a coating that can be applied on the surface of a multitude of different woods, plastics and home furnishings. The thermoplastic product acts in the solid phase as a protective barrier that can withstand intense heat inputs. The barrier slows the release of potentially toxic and combustible vapors normally released from burning materials. Also, the phosphoric acid existing in the polymer blend serves to induce an added char barrier that further inhibits vapor release.

KVTV created Freeze Flame Nano through researching modern flame retarding techniques. NASA has been studying the effects of thermosets and thermoplastic coatings on their re-entry vessels. Thermoplastics easily adhere to numerous surfaces and resist high heat inputs. Unlike thermosets, thermoplastics can be melted and remolded. Similarly, they have increased moduli of elasticity and lowered glass transition temperatures. Although the values have not been experimentally determined, it is expected that Freeze Flame Nano will have extremely low vapor pressures at high temperatures as well as have high enthalpies of vaporization, resulting in better flame retardancy.

The flame retardant coating that KVTV is proposing consists of 50% polyvinyl alcohol, 15% phosphate, 3% Cloisite, and 32% water. A market analysis was performed to determine the demand that KVTV can capture. It was determined that the maximum demand that Freeze Flame Nano could capture would be 6.7 million pound per year. KVTV recommends that the production plant for Freeze Flame Nano be built in Corpus Christi, Texas. The total capital investment for this process is $1.7 million. The net present worth of this ten year venture is $15.3 million.