PERFORMANCE Chemicals, LLC

ISO 9001:2008 Certified

BURN-OUT™ Durable Green Non-Toxic Flame Retardant

Re-submitted: 12-29-11

Primary Sponsors: Robert T. Currier
Michael R. Currier

Company Name: Performance Chemicals, LLC
10 Chenell Drive
Concord, NH 03301
603-228-1200
Web Site: www.performancechemicalsllc.com

Contact Person: Robert T. Currier
Title: Vice President
Address: 10 Chenell Drive
Concord, NH 03301
Phone: 603-228-1200
Email: bobperformance@aol.com

Contributor: Lydall Performance Materials
Specialty Insulation Group
68 George Street
Green Island, NY 12183
518-273-6320

Description:
Burn-Out™ is a durable (water, alcohol, oil and grease resistant) green, non-toxic, formaldehyde-free, flame retardant that contains no: halogens, APEOs, carcinogens, VOCs, polybrominated diphenyl ether (PBDE), decabromodiphenyl ethers (decaBDE), antimony, boric acid/borates, lead or arsenic. This alternative chemistry replaces currently used persistent, bioaccumulative, toxic materials.

Research for Burn-Out™ technology began in 2008 and has been implemented and the manufacturing process commercialized in 2011. All components are listed under TSCA and all ingredients are REACH compliant. Commercialized products are UL 94 V-0 and ASTM E-84 capable, subject to user/customer formula and testing. Performance is equal to or exceeds currently used products and offers significant cost and use savings (please refer to "economics" section in the abstract). Burn-Out™ has been applied to non-wovens, paper, corrugated materials and formulated in adhesives and coatings with no burn or after-glow. It is a candidate for bedding/mattress applications.

Nominated Technology:
Burn-Out™ technology is eligible for the Small Business Award, Focus Area 3: Technology that includes Green Chemicals.

Identification of the EPA Award Focus Area:
The design of greener chemicals resulting in products that are less hazardous than the products they replace. Our products offer no toxicity and are safe to manufacture and apply. Burn-Out™ cleans up with soap and water and is safe for disposal.

Description of US Component:

The research, development, testing, scale-up and manufacturing of Burn-Out™ occurred totally within the United States of America.

Abstract

Description:
Burn-Out™ is a totally green, non-toxic, durable flame retardant. The active FR ingredients, phosphorous and nitrogen, assist in the release of carbon dioxide that dilutes the air of oxygen and flammable decomposition products of the material that is burning. The resulting carbonaceous char forms a barrier to oxygen. The intumescent coating is enhanced when combined with starch based materials. Burn-Out™ may be used in virtually all aqueous systems and many polymer systems.

Problem Addressed:
Burn-Out™ flame retardants replace, halogen containing materials, PBDEs, DBDEs, antimony, alumina, boric acid/borates, heavy metals, and are formaldehyde free. This alternative chemistry replaces currently used persistent, bioaccumulative, toxic materials. Unlike other flame retardants, Burn-Out™ is durable, resisting water, alcohol and grease.

Applications include:
Paper, corrugated packaging materials, woven and non-woven textiles, insulation materials, ceiling tiles, other construction materials (wood, urethane insulation and steel intumescent coatings), adhesives, paints and other FR coatings especially in the automotive, military and marine markets are key applications. Plans are to test Burn-Out™ in bedding/mattress materials.

Additional Benefits:
The durability of the technology allows it to resist water, alcohol and grease/oil materials. Burn-Out™ contains ingredients that resist bacteria and fungi and when used in insulation materials resists water and the formation of air borne Legionella bacteria which can multiply in any kind of water system and is considered a source of Legionnaire Disease (Mayo Clinic Staff Report).

Hazardous Substances Eliminated (Source Reduction):
The Burn-Out™ flame retardant compound is comprised of materials that are FDA compliant for indirect food contact and as such, eliminate 100% of the hazardous flame retardant materials they replace and are safe for disposal.

Economics:
The Burn-Out™ flame retardant compounds, in customer formulations, offers the potential for overall systems cost savings as compared to currently used halogen and PBDE/Antimony based products. Burn-Out™ cleans up with soap and water, saves on toxic tracking documentation and reduces landfill disposal costs associated with currently used hazardous materials, offering significant systems cost savings.

Detail how technology meets the scope of the program and selection criteria:

Background:
Performance Chemicals, LLC has been supplying flame retardant products for many years. In each case, our products are made to the specific requirements of our customers with Two-Way NDAs in place as the vehicle to exchange information and to keep all disclosures confidential. As a result, we are restricted from disclosing specific customer formulations and product test results.

While there is considerable debate on the impact of PBDEs a 2006 report entitled "Brominated Flame Retardants: A Burning Issue", was released by the American Council on Science and Health which concluded that "by any measure, the benefits to public health and safety of PBDEs outweigh the risk related to their production and use". For overall health and safety reasons many have reached the same conclusion because, at that time, there was no viable non-toxic alternative to PBDE chemistry. Today, there is growing evidence that PBDEs are toxic and our Burn-Out™ technology eliminates this toxic hazard.

Problem addressed:
A number of years ago, we were contacted by a customer to make their flame retardant paper durable to water submersion. While their requirement was for a 5 minute hold-out without loss of flame retardancy, our results showed we could offer water hold-out for days even with full immersion. Additional laboratory work has extended the duration to be indefinite without loss of flame retardancy.

Knowing the toxicity issues with currently available technology, Performance Chemicals set out to find a safe, non-toxic, non-bioaccumulative and non-persistent technology that performs equal to or better than currently available flame retardants. Initial work showed promise in meeting this objective however, there were stability issues that required resolution. The revised objective then, was to develop a cost effective system that would be compatible with currently used FR formulations in virtually all available polymer system. After evaluation of over 70 competitive FR products by our customers and contributor through our combined testing, we believe Burn-Out™ technology is capable of substituting for current FR materials in most existing formulations. This should significantly enhance the market acceptance and use of our non-toxic alternative FR technology.

Please Note: The scope of the initial work was to develop a product that is non-toxic and performs at least equal to the current toxic technology. While our lab work suggests our systems may be more efficient than currently available products, actual demonstration of how much more efficient Burn-Out™ is, will be the subject of future testing and customer evaluation.

Currently Used Products and Chemistry:
PBDEs are used at an estimated annual rate of 4 billion pounds and are incorporated in virtually every type of flame retardant plastic, paper, textile, paint and coating application. The bromine, in PBDE, provides flame retardancy in the gas phase of combustion, by removing hydrogen and hydroxyl radicals, which combust at the same general temperature as most polymers. PBDE is relatively economical to use and combines relatively easily with most plastic polymers and resin systems (information in part from the ACSH Report noted earlier).

Burn-Out™ Chemistry and comparison to existing technology:
Burn-Out™ flame retardant chemistry, works by forming an intumescent, thermal insulative barrier between the burning and unburned material. The carbonaceous char acts as a barrier to flame by offering insulative properties slowing the transfer of heat to the unburned portion. Inert gasses, mostly carbon dioxide and water, act to dilute combustion gases, cooling the coating or substrate surface by lowering their partial pressure and the partial pressure of oxygen resulting in a slowing of the combustion reaction rate. Phosphorous containing compounds act in the solid phase reacting to form phosphoric acid (H2PO3), causing the material to char. Nitrogen forms a cross-linking molecular structure releasing nitrogen gas diluting the flammable gases, working in synergy with the phosphorous.

Toxicity Comparison and impact on the environment and quantities of hazardous substances reduced or eliminated:
The active FR components in Burn-Out™ are non-toxic and can be formulated as an ingredient into food grade compounds. Being direct and indirect food additives their use eliminates 100% of the hazardous flame retardant materials they replace and are safe for disposal in accordance with local and government regulations.

Burn-Out is formaldehyde free.

Degree of implementation in commerce and testing relevancy:
Burn-Out™ is commercially available and has been successfully tested and placed into production by our customers and our Contributor to this entry.

Flame retardancy: Equal to or better than the products it replaces. Tests conducted include UL-94 V-0 and ASTM E-84. There is no after-glow when the flame is removed. Going forward, UL will certify end use products using Burn-Out™ by our customers in their formulas.

Physical properties: Results are equal to or are better than the products they are intended to replace (tensile, hardness/durometer, wear, impact resistance, flexing and etc). Specific values are not available as test result detail would compromise customer NDAs.

Durability: Water, oil and grease repellency testing exceeded products made with PBDEs.

Product Clean-up: Burn-Out™ cleans up with soap and water and can save the user significant production, labor, and hazardous waste disposal costs.

Disposal: Burn-Out™ FR ingredients are non-toxic and may be disposed in a land fill or incinerator in accordance with local and government regulations. Burn-Out™ chemistry protects the environment by eliminating persistent, bioaccumulative toxic materials.

Other technical, human health benefits impacting children's exposure:
Burn-Out™ may be formulated to resist water, bacteria and fungi when used in insulation materials by repelling water and the formation of air borne Legionella bacteria which can multiply in any kind of water system per and is considered a source of Legionnaire Disease Mayo Clinic Report).

Depending on the formula, Burn-Out™ can reduce the amount of dust from cutting insulation materials, lowering air borne particulates, reducing eye, skin and respiratory irritation. A patent regarding reduction of irritation and dusting in insulation, cellulose, carpet and textile materials is pending.

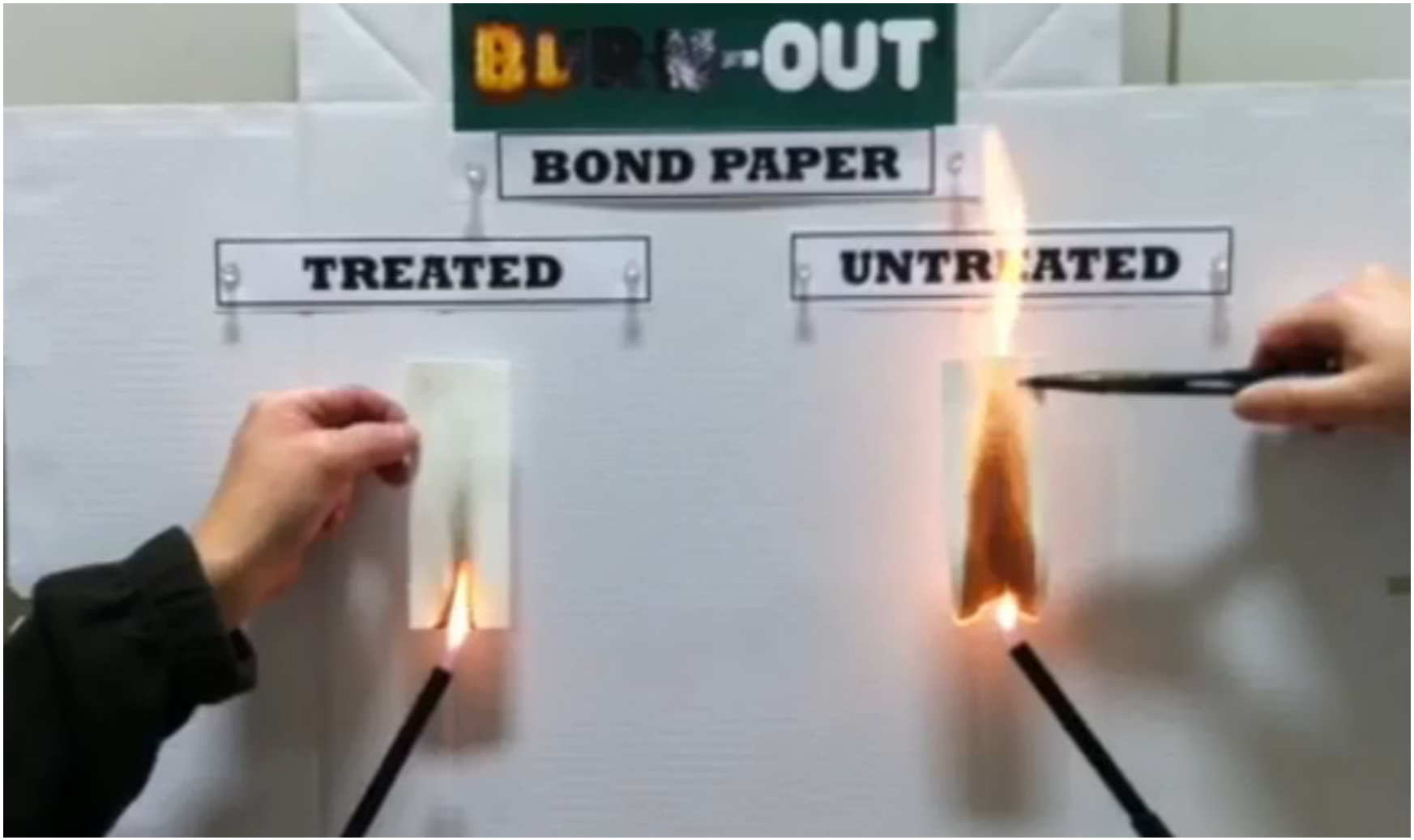
Future testing is planned for use and application in bedding and clothing as well as carpet and paper products that could adversely impact health and safety of children.

Environmental and economic benefits (cost comparison, performance and economic profile:
Burn-Out™ system costs are significantly reduced because of the ease of use, clean-up, manufacturing change over efficiency, elimination of toxic materials and tracking of those materials and lower disposal costs. Overall cost reductions can range from 20-50%.

Product and market applicability:
Burn-Out™ technology is applicable for use in solid and liquid applications. Polymer systems include: silicone, acrylic, styrene, urethane, epoxy, polyimides, polyamides, polyethylene, organic elastomers, wood and steel coatings, paints, insulation foams and many others.

Markets include: textile, clothing, paper, corrugated packaging materials, bedding materials, carpeting, wall coverings, adhesives, automotive, military, aircraft, aerospace, construction, potting and encapsulating electronic, electrical, paint and coating markets.

Potential benefits and drawbacks from feed-stocks, manufacturing, product use and product disposal:
Availability of feed-stock is not an issue. Manufacturing and capacity are available for immediately delivery.


BURN-OUT
BOND PAPER
TREATED
UNTREATED

Introducing BURN-OUT™

Green Flame Retardants

ECO FRIENDLY

- NO TOXINS
- NO HALOGENS
- NO APEOs
- NO CARCINOGENS
- NO FORMALDEHYDE
- NO VOCs

PC GREEN™

CAPABILITIES

- UL 94
- ASTM E-84
- NFPA 255
- REACH COMPLIANT

OPTIONS

- DURABLE FLAME RETARDANTS

APPLICATIONS

- PAPER / CORRUGATED
- TEXTILES / NON-WOVENS
- PAINTS AND COATINGS
- INSULATION MATERIALS
- ADHESIVES
- CONSTRUCTION MATERIALS
- ELECTRICAL INSULATION / PAPER
- AND MANY MORE!

ISO 9001:2008 REGISTERED

PERFORMANCE CHEMICALS, LLC

SCAN THE CODE OR VISIT US @ WWW.PERFORMANCECHEMICALSLLC.COM