EnComP™

COATING REACTIVE MATERIALS WITH NON-REACTIVE MATERIALS AND VICE VERSA

Energetic Materials

Energetic materials are a class of materials with high amounts of stored energy that can be released. These include propellants, nanothermites, explosives, thermobarics, and pyrotechnic compositions. These materials have a wide range of applications, including use in smoke producing munitions, mass-efficient radiation shielding, collision/micrometeroroid impact energy adsorption, and pyrotechnic flares. Despite their range of potential markets, use of energetic materials is often limited by safety concerns associated with material sensitivity and long term storage.

Powdermet has addressed these safety concerns by developing methods to coat reactive materials and fuels with nonreactive materials and vice versa. Furthermore, by utilizing our processing methods, we can tailor the performance of a material. For example, by administering the appropriate coating and energetic material formulation, Powdermet can adjust and control the energy release rate, burn time, and burn temperature.

The schematic shown to the right (Fig. 1) is a simplified representation of Powdermet's novel energetic material. The core material is comprised of a reactive material (energetic) that otherwise would be unstable without applying an inert surface layer containing additives such as accelerants, binders, and/or colorants. In addition to providing stability, materials used in the outer layer allow for modification and control of the burn and energy release characteristics.

The specific properties of an energetic material are dependent on the composition, particle size, surface area, and preparation techniques used to produce the final product. By adjusting these parameters, different properties can be achieved, allowing seemingly similar materials to be tailored to very specific applications.

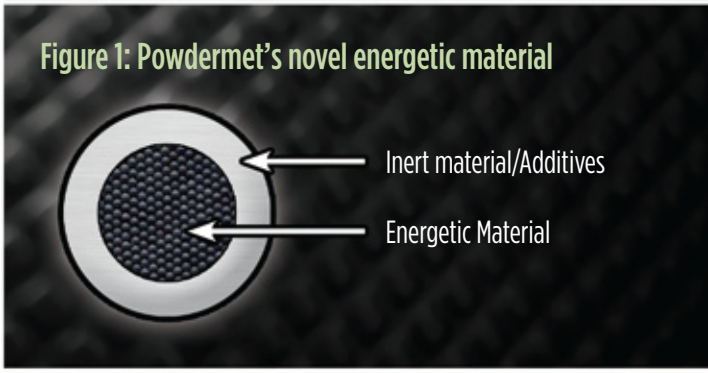

Figure 1: Powdermet's novel energetic material

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Energetic Materials, Cont'd

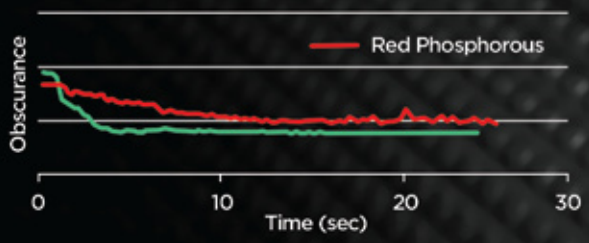
The novel energetic materials being developed by Powdermet have the potential of providing 3-4x increased energy release rate compared to conventional formulations, while having a more tailored performance to the specific application, as well as decreased sensitivity and improved storage capabilities.

Using the aforementioned techniques to prepare energetic materials, Powdermet has used known materials in novel configurations to produce a structurally capable radiation shielding composite. For the production of this composite, nano-sized lithium borohydride, LiBH4, (highly reactive with atmospheric moisture) is encapsulated in a nonreactive shell and then cast in a polyethylene matrix. The polyethylene/LiBH4 is then cast in alternating layers with a structural material, such as Kevlar or carbon fiber, to produce an ultra-strong, lightweight, radiation shielding composite.

Radiation Shielding Material	Density (g/cc)	Radiation Shielding Effectiveness	Tensile Strength (MPa)
5% Borated Polyethylene	1.01	1.37	17
Powdermet's LiBH4 Composite	1.07	1.40	152

Another project involves the development replacement material for red phosphorus (RP) in obscurant smoke munitions. RP converts to phosphoric acid over time, which is highly corrosive and produces a toxic gaseous byproduct. Its shelf-life is 35 years, during which time, HAZMAT teams routinely need to "burp" the munitions to remove these toxic gases. Furthermore, once the munition is detonated, troops are exposed to these toxic byproducts, which have shown to have adverse health effects on soldiers.

VIS Performance



By utilizing a SO core mixture coated with a particle-enhanced binder, Powdermet has produced a safer alternative to the current technology that perform with 115% of the baseline of RP performance in the visible spectrum and 80% of the performance of RP in the IR spectrum.

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