Fire-proof Pyrotechnics: Desensitizing Ignition of Energetic Materials When Exposed to Accidental Fire

Technology marketing summary:

Composite energetic materials are extremely useful for a variety of applications, but their potential for unintended detonation is a serious safety consideration. Ignition of pyrotechnics by accidental fire has resulted in several catastrophic events causing significant loss of life and property. Susceptibility to unplanned detonation continues to be a major risk associated with transport, handling and storage of these materials. Current methods for mitigating that risk include limiting quantities and carefully guarding transport and usage.

Researchers at Idaho National Laboratory have developed a technique for rendering composite energetic materials inherently resistant to accidental ignition by fire. Incorporating an additive that breaks down at the lower temperatures associated with fire ensures that the material, following exposure to fire, can no longer be detonated by higher ignition rates. Additive-treated composite energetic materials will vastly improve safe handling, transport, storage and use of these materials.
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Technology description:
Typical hydrocarbon-based fires produce heating rates on the order of 100 degrees C per minute, enough to ignite and detonate common composite energetic materials. Igniters are designed to produce heating rates of around 1 million degrees C per minute. Leveraging this temperature difference, INL scientists replaced a portion of the oxidizer with ammonium nitrate, which breaks down at around 210 degrees C. When intentionally ignited, the additive-treated mixture detonates normally. However, if the material is exposed to accidental fire, the additive will decompose, leaving the material too fuel-rich to ignite and inert to higher ignition rates.

Technology benefits:
- Composite energetic materials are rendered inert by accidental fire, making transport, storage and use of these materials much safer
- If composite energetic materials are not exposed to accidental fire, they will perform as designed when intentionally ignited

Applications:
Military, police, mining, pyrotechnics, quarrying, oil and gas exploration

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