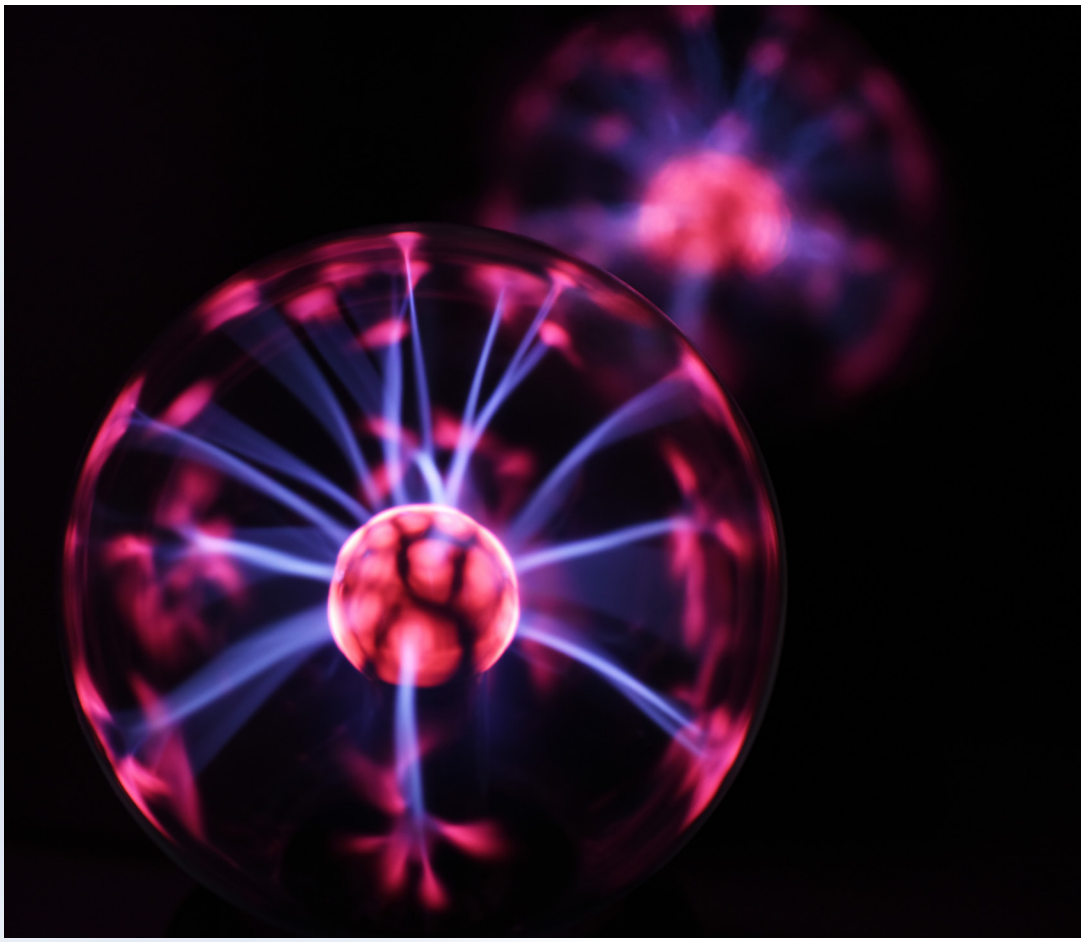

Electrostatic Discharge Resistance: Making Safer Energetic Materials

Technology marketing summary:

Unintended electrostatic discharge can cause explosive situations when contacting energetic materials such as fuels, pyrotechnics and industrial explosives designed for controlled detonations. Scientists at Idaho National Laboratory and Texas Tech University have developed a patent-pending method to produce and handle powdered composite energetic materials. The addition of nanofillers controls ignition sensitivity to electrostatic discharge, making them less hazardous to produce, transport and control.

Technology description:

The research team added nanofillers to a representative composite energetic material made of aluminum powder (fuel) and polytetrafluoroethylene (PTFE) powder (oxidizer). Carbon nanotubes act as the controlling nanofillers to influence electrical conductivity and electrostatic discharge ignition sensitivity. The nanotubes' shape allows them to surround fuel and oxidizer particles, raising the percolation threshold of the material and improving connectivity throughout the reactant matrix. In fact, researchers found that, when mixed correctly, the addition

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The Energy of Innovation

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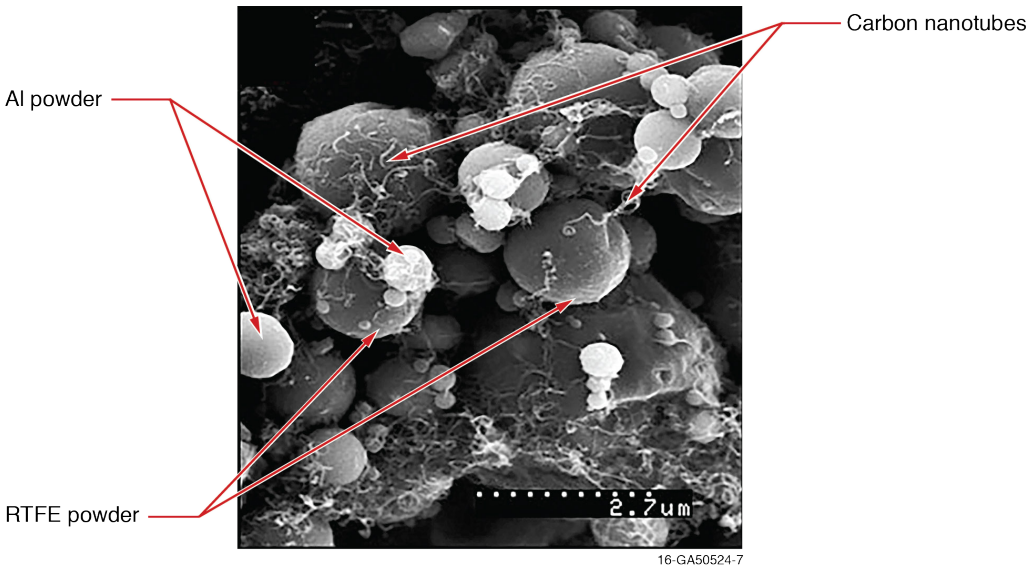

Figure 1: Adding 1 volume percent carbon nanotubes creates a conductive network around fuel and oxidizer particles

of carbon nanotubes increased conductivity throughout the mixture so significantly that the addition of just 4 volume percent graphene nanoplatelets or 1 volume percent carbon nanotubes increased conductivity by almost 10 orders of magnitude.

When voltage was applied to experimental mixtures, those with high electrical conductivity due to the addition of nanofillers did not ignite. Instead, the current traveled through the nanofillers, bypassing the energetic material and preventing it from heating and igniting. The energetic material remains fully responsive to normal ignition methods.

INL's process for controlling ignition sensitivity of powdered composite energetic materials to electrostatic discharge will significantly impact safe handling of these materials for a broad range of applications. The process can be tailored for a wide variety of energetic materials.

Technology benefits:

- Reduces risk of ignition of powdered composite energetic materials by electrostatic discharge
- Improves material stability for a variety of composite energetic materials ranging from flash powder to thermites
- Protects workers and public from unexpected detonation of energetic materials

Applications:

Military, police, mining, quarrying, oil and gas exploration

For more information

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