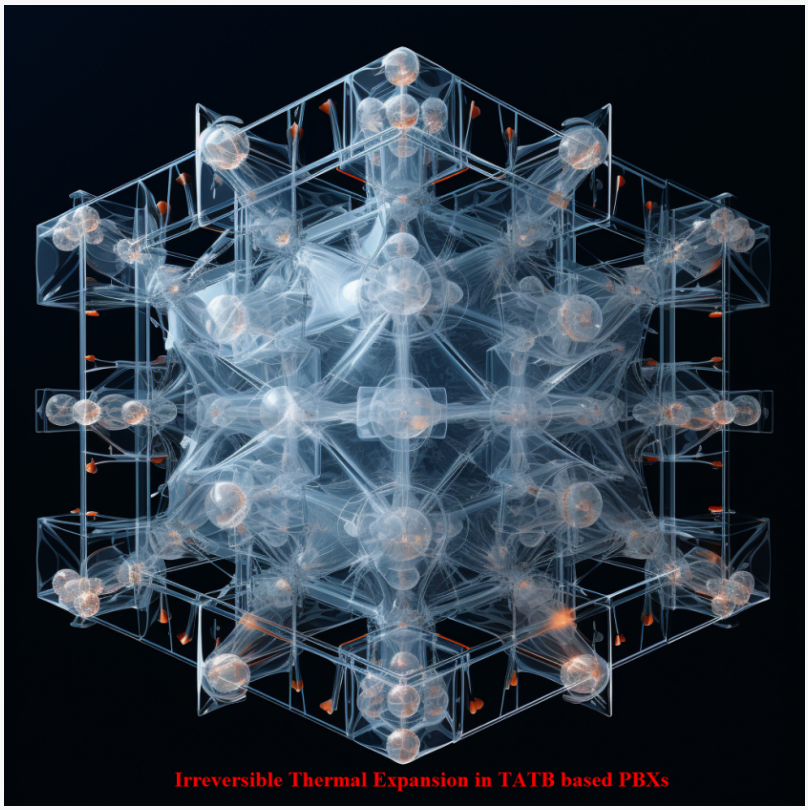
Research progress in thermal expansion characteristics of TATB-based polymer bonded explosives

CHINA, December 13, 2023 /EINPresswire.com/ -- The researchers investigated the critical issue of irreversible thermal expansion in TATB -based Polymer Bonded Explosives (PBXs), a problem significantly impacting their environmental adaptability and safety. The researchers underscore the urgent necessity to understand the fundamental mechanisms more profoundly and outline possible pathways for future studies. This research sketches a roadmap that serves as a guide for future explorations aimed at enhancing the safety and applicability of TATB-based PBXs.



IRREVERSIBLE THERMAL EXPANSION IN TATB BASED PBXS.

Under complex temperature variations, the irreversible thermal expansion of polymer-bonded explosives (PBXs) containing 1,3,5-triamino-2,4,6-trinitrobenzene (TATB) leads to diminished shape stability. This, in turn, directly impacts the mechanical properties and safety performance during storage and use. In recent years, extensive and thorough research has been carried out to investigate the thermal expansion characteristics of TATB-based explosives.

In a study published in the KeAi journal Energetic Materials Frontiers, a group of researchers from China, explored the distinctive crystal structure of TAT and the thermal expansion mechanism of TATB-based PBXs. Additionally, they summarized the microstructural evolution during the thermal expansion process, and analyzed the consequential effects of thermal expansion on the overall performance of these explosives.

“More attention was paid to the influencing factors of thermal expansion and control methods. Evidently, designing a new structure of negative thermal expansion binding system, through the design of negative thermal expansion polymers or fillers and positive expansion TATB crystals, can reduce the linear expansion coefficient of PBXs,” explained the study’s lead author Cong-mei Lin. “This approach not only suppresses material thermal expansion, but also holds broad application prospects.”

Notably, suppressing the irreversible thermal expansion of TATB based PBXs and improving the shape stability of the explosive under temperature cycling environment is important. However, effectively suppressing thermal expansion of TATB-based PBXs remains a challenge.

"Going forward, we need to focus on the irreversible expansion mechanism of TATB-based PBXs; TATB crystal structure design and control; the design and development of new structural-functional integrated polymers; and the application of new negative thermal expansion functional materials."

The authors believe that the development of structural design of TATB and binder system and the application of negative thermal expansion functional materials will bring new opportunities to suppress the thermal expansion of TATB based PBXs and enrich the modification techniques of energetic composites.

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