Hydorgen Peroxide Solvates with High Energetic Content

Technology #7225

Explosives, and related energetic materials such as propellants and pyrotechnics, have a large amount of stored chemical energy that can be released with a suitable initiation event. The rapid release is facilitated by the proximity of fuel and oxidizer within the molecule. However, the vast majority of compounds used as explosives are under-oxidized, which decreases their performance. The widely used energetic materials CL-20 and HMX are examples of this. While optimization of oxygen balance is known to improve the performance of an energetic material, utilization of this approach has been complicated by the fact that introduction of additional oxidizer will typically decrease the density of the material, which degrades the overall performance by decreasing the detonation velocity and pressure.

Using hydrogen peroxide solvates to improve oxygen balance of CL-20

To address this dilemma, University of Michigan researchers replaced water molecules in the partially hydrated solvate of CL-20 with the oxidizer hydrogen peroxide, forming two polymorphic energetic solvates with exceptional performance as energetic materials. Both polymorphic solvates have an optimized oxygen balance versus that of ε-CL-20 (the gold standard form of CL-20) as well as the hydrated solvate, α-CL-20. Utilizing the thermochemical code Cheetah 7.0, both solvates were found to have improved detonation parameters (velocity and pressure) over the hydrated solvate of CL-20. The orthorhombic hydrogen peroxide solvate is predicted to exceed even the detonation parameters of ε-CL-20. Notably, this increase in performance is achieved without any increase in sensitivity.

Applications

* A component of solid propellants in rocket boosters for satellites or space travel
* A component of explosive devices
* A component of specialized gun propellants
* A method for demolition, as a ‘cutter’ in demolition cords
* Higher performing replacement for CL-20

Advantages

* Predicted increase in detonation parameters (velocity and pressure)
* No increase in impact sensitivity of the material
* Increased oxygen balance (OB) parameters versus that of ε-CL-20 and α-CL-20
* Potentially generalizable to other oxygen deficient solvates of known energetic materials

**Inventors**

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