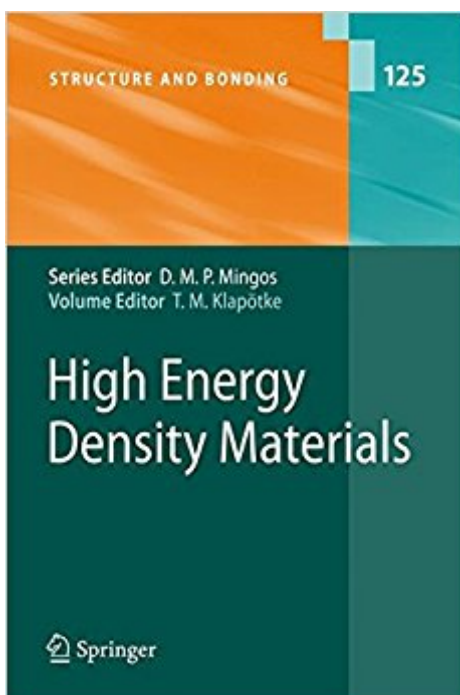


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High Energy Density Materials (Structure And Bonding)



Synopsis

This book summarizes some recent developments in the area of high-energy high-density (HEDM) materials. Rather than being comprehensive in scope, emphasis is given to structural and bonding features of highly energetic materials with possible applications as high explosives (secondary explosives) or propellants. In this book we do not focus on primary explosives (e.g. lead azide replacements) since by definition the explosive performance (detonation velocity and detonation pressure) of such materials - although very sensitive - are much less energetic than secondary (high) explosives. Modern HEDMs derive most of their energy (i) from oxidation of the carbon backbone, as in traditional energetic materials, (ii) from ring or cage strain, or (iii) from their very high positive heat of formation. Examples of the first class are traditional explosives, such as TNT, RDX and HMX. Modern nitro-compounds, such as CL-20 or the recently reported hepta- and octa-trocubanes, belong to the second group of explosives and possess very high densities and enhance the energies utilizing substantial cage strain. Members of the third class of compounds are high-nitrogen compounds (up to 85% nitrogen content), such as aminotetrazole and nitrotetrazole derivatives, which show the desired remarkable insensitivity to electrostatic discharge, friction and impact, while having very high positive heats of formation and therefore very high explosive powers. The synthesis of energetic, non-nuclear materials for military application has been a long-term goal in various academic and military research groups worldwide. Some of the current challenges that face HEDM scientists are: Demand for environmentally compatible and toxicologically acceptable explosives and propellants. Examples are replacements for TNT, RDX and HMX since nitro-explosives per se, as well as their environmental transformation products, are toxic.

Book Information

Series: Structure and Bonding (Book 125)

Hardcover: 286 pages

Publisher: Springer; 2007 edition (August 23, 2007)

Language: English

ISBN-10: 3540722017

ISBN-13: 978-3540722014

Product Dimensions: 6.1 x 0.7 x 9.2 inches

Shipping Weight: 1.4 pounds (View shipping rates and policies)

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