

The 12 Principle of



Green Chemistry With A Corresponding Green Nanotechnology Approach



Green chemistry is a method of implementing green nanotechnology that attempts to increase efficiency while minimizing negative consequences for environmental contamination. While no reaction can be completely "green," the overall negative impact of nanotechnology research and industry can be mitigated by following the 12 Principles of Green Chemistry wherever applicable.

1. Prevent waste.



Develop novel "greener" chemical nanomaterial syntheses that decrease or eliminate waste streams and products at the source by including pollution avoidance into the design.

2. Production harmless chemical



Produce nanomaterial with the necessary physicochemical characteristics and less or no toxicity

3. Design less hazardous chemical.



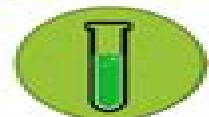
Work towards developing syntheses that use environmentally friendly reagents and solvents to produce compounds with little or no toxicity to humans and the environment.

4. Use renewable feedstocks



Use sustainable and environmentally friendly raw materials and feedstock.

5. Utilize catalysts



Utilize nanocatalysts produced in a green manner to reduce waste. Develop catalytic techniques that can improve reaction selectivity and overall process efficiency significantly.

6. Avoid chemical derivatives



If at all possible, avoid employing blocking or protective groups, as well as any temporary alterations. Utilize selective nanosyntheses to eliminate solvent-intensive syntheses.

7. Maximize atom economy



Design and develop syntheses such that the end product includes as much of the raw ingredients as possible.

8. Use safer solvents



Hazardous solvents, separating agents, and other auxiliary chemicals should be avoided. To improve materials efficiency and minimize processes, use a bottom-up strategy.

9. Increase energy efficiency



Develop synthesis methods that, if possible, are carried out at room temperature and pressure. Develop synthesis methods that, if possible, are carried out at room temperature and

10. Design chemicals and products



Assess and quantify the nanomaterial's behavior in the environment, study their fate and major chemical interactions with other particles or organisms. Design nanomaterial's to degrade

11. process control to prevent



Develop a nanoscience Life Cycle Assessment (LCA), which is a critical tool for controlling risks in nanoscience research, development, and commercialization.

12. Minimize the accidents



Minimize the potential for chemical accidents including explosions, fires, and releases into the environment.

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S Ben Porath



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Green Pyrotechnics Principles and Applications Sabatini, 2014-08-13 The first of its kind this book is all set to become the leading source of information on environmentally friendly pyrotechnics for many years to come Written by a leading expert working at the Pyrotechnics Technology Division of the US Army the book covers the formulation of explosives their chemistry and applications geared at the development of safer and greener pyrotechnics It addresses European and US governmental directives and policies that regulate the manufacturing usage and environmental impact such that both military and civilian researchers and developers can incorporate the concepts of green pyrotechnics in their daily work The text equally caters to the needs of commercial suppliers of fireworks and stage pyrotechnicians Green Energetic

Materials Tore Brinck, 2014-01-15 This comprehensive book presents a detailed account of research and recent developments in the field of green energetic materials including pyrotechnics explosives and propellants This area is attracting increasing interest in the community as it undergoes a transition from using traditional processes to more environmentally friendly procedures The book covers the entire line of research from the initial theoretical modelling and design of new materials to the development of sustainable manufacturing processes It also addresses materials that have already reached the production line as well as considering future developments in this evolving field **Chemistry of Pyrotechnics** Chris

Mocella, John A. Conkling, 2019-01-15 This book provides chemists with technical insight on pyrotechnics and explosives It emphasizes basic chemical principles and practical hands on knowledge in the preparation of energetic materials It examines the interactions between and adaptations of pyrotechnics to changing technology in areas such as obscuration science and low signature flame emission The updated third edition discusses chemical and pyrotechnic principles components of high energy materials elements of ignition propagation and sensitivity It offers heat compositions including ignition mixes delays thermites and propellants and investigates the production of smoke and sound as well as light and color **Encyclopedic**

Dictionary of Pyrotechnics K.L. Kosanke, Barry T. Sturman, Robert M. Winokur, B.J. Kosanke, 2012-10 **Military**

Pyrotechnics Ajoy K. Bose, 2021-12-13 This book covers military pyrotechnics characteristics sensitivity combustion performance parameters ingredients and their behaviour various pyrotechnic compositions and their manufacturing methods filling pressing and assembly of ammunition and so forth Divided into two broader sections namely military pyrotechnic compositions and military pyrotechnic ammunitions and devices it provides full spectrum of military pyrotechnics and a guide for all personnel involved with management of military pyrotechnic ammunitions and devices in design production inspection training and use Features Answers know what know why and know how of pyrotechnic compositions and pyrotechnic ammunitions and devices Explains various concepts and mechanisms of the military pyrotechnics Deliberates on role and characteristics of pyrotechnic compositions and its classification Discusses various factors affecting performance and some differences in military pyrotechnics Describes various methods of initiation of ignition in ammunition Elucidates basic

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