Review of
The Chemistry of Explosives

Jacqueline Akhavan
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This 173-page, paper-bound book was published by the Royal Society of Chemistry (RCS) and authored by Jacqueline Akhavan of Cranfield University, Royal Military College of Science, United Kingdom. The text potentially helps fill a gap in the literature of explosives by providing more information on the chemistry of manufacturing and functioning of explosives. Unfortunately, it still is much more a text about explosives than it is about the chemistry of explosives. Even more unfortunately, it is not a particularly good book. Its approach is fairly superficial and it contains a disturbing number of errors.

Writing a text book is an incredibly ambitious undertaking, especially for an individual author. Not only is there the need to assemble a tremendous amount of information, but also that information needs to be essentially 100% correct. Even being 99% correct is really not good enough. Probably what was needed, in the case of this text, was one or two additional authors (or paid editors) to help identify and eliminate the more consequential errors that found their way into the text. If these errors are corrected in the second edition of this work, it would be a fairly good general reference text, and if it is expanded to include more actual chemistry, it would potentially be quite a good text.

Chapter 1, *Introduction to Explosives* is a brief and fairly interesting historically based discussion of explosives.

Chapter 2, *Classification of Explosive Materials* identifies the classes of explosive materials and goes on to present a moderate amount of

technical information about a collection of primary and secondary high explosives.

Chapter 3, *Combustion, Deflagration and Detonation* is a summary of some basic information about these processes, with the greatest attention paid to detonation.

Chapter 4, *Ignition, Initiation and Thermal Decomposition* is a brief introductory discussion of these subjects.

Chapter 5, *Thermochemistry of Explosives* is a fairly thorough discussion of the subject as applied to secondary high explosives, especially considering the length of the text. Here there is a greater emphasis on chemistry than most texts on explosives.

Chapter 6, *Equilibria and Kinetics of Explosive Reactions* contains some information rarely seen in texts on explosives, but only addresses secondary high explosives.

Chapter 7, *Manufacture of Explosives* is an interesting presentation of general information on the manufacture of various high explosives.

Chapter 8, *Introduction to Propellants and Pyrotechnics* is an extremely brief introduction to broad and complex subjects.

Some of the more noteworthy strengths of this text are its Table of Contents and Subject Index, both of which are extensive and definitely facilitate using the text for reference. Also it provides more information about the chemistry than most other texts on explosives.

As stated above, the greatest weaknesses of this text are that it only contains a little more chemistry than other texts on explosives, and that it contains a troublesome number of errors as well. A few examples of these errors are:

Page 23 lists "potassium chlorate" as a primary explosive, when it definitely is not.

Page 46 gives atmospheric pressure as 9.869 $N \cdot mm^{-2}$ and uses this number in a calculation, when this pressure is about 100 times too great.

Page 56 states that deflagrating explosives are "not affected by strength of container", when there is little if anything else that affects their performance more than the degree of confinement.

Page 59 incorrectly identifies the thermal runaway (or critical) temperature as the ignition temperature for a pyrotechnic.

Page 65 states "Almost all explosive trains contain a primary explosive as the first component." One of the most common explosive trains is the detonator (blasting cap), which begins with a pyrotechnic igniting and/or delay charge before the primary high explosive component.

Page 68 states "The amount of chemical energy H generated by the decomposition of an explosive will give information on the sensitivity of the explosive … a high value of H will result in a more sensitive explosive." This seems to be a confusion of enthalpy (heat) of reaction and activation energy. It is also wrong and is contradicted by Table 5.12 in this text, which documents primary (sensitive) explosives as generally being poorer energy producers than secondary (relatively insensitive) explosives.

Page 76 states "The heats of formation for a reaction containing explosive chemicals can be described as the total heat evolved when a given quantity of a substance is completely oxidized in an excess amount of oxygen, resulting in the formation of carbon dioxide, water and sulfur dioxide." At best this is a bad mix of definitions for heat (enthalpy) of combustion and heat (enthalpy) of reaction; and it definitely is not correct.

Page 95 equates force (F) to (nRT) and (PV), when the terms from the ideal gas equation have the units of work (force times distance).

Page 154, when discussing heat-generating devices, states "Heat generating pyrotechnic compositions contain zinc, zirconium or barium chromate, and manganese.", when at best this is overly simplistic and appears to be a failed attempt to borrow from Ellern's *Military and Civilian Pyrotechnics.*

For additional comments regarding the chapter on pyrotechnics, see the following review by Barry Sturman. It is hoped that there will someday be a corrected and expanded second edition of this book, and that it will then become the excellent text it could be.