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Thermochimica Acta 285 (1996) 383–386

thermochimica
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Book Review

Thermal Hazards of Chemical Reactions Volume 4, Industrial Safety Series

T. Grewer

**ISBN: 0-444-897224; pp 424; Price: NLG 380.00
Elsevier, Amsterdam, 1994**

Incidents caused by runaway chemical reactions, often leading to the escape of toxic substances, have become of great public concern. As the public image of the process industry is at stake, the industry concerned takes great efforts to improve the process safety of their installations. Thus the monograph of T. Grewer fills an important gap in the literature on a vital item of process safety.

The author has been active in process safety for almost all his professional life and now at the end of his successful industrial career, as he states in the preface to the book, he wants to pass on his experience to younger colleagues interested in the safety of chemical plants. He is a leading expert in this field of research and renowned for his own research achievements. On the other hand he has been involved all his professional life in solving practical safety problems in the chemical industry so that his advice given in the book is of particular practical relevance.

The book gives a systematic overview of the phenomenology of exothermic reactions and thermal hazards together with a basic theoretical understanding. The emphasis is on practical applications in the chemical industry as regards test methods, interpretation of test results and preventive measures. After an introductory chapter on explosion types, characteristic data and incidents involving exothermic reactions and the common understanding of the risks of runaway reactions, the phenomenology of explosions in reacting systems is described. The explosion can be caused by a primary reaction, which is usually the desired reaction, or by a secondary reaction for which the necessary temperature level has been provided by the first reaction. The particularities of exothermic decomposition and autocatalytic reactions are discussed. The actual explosion is described as a thermal explosion based on the theories of Semenov and Frank-Kamenetskii. Deflagration and detonation of condensed material are also dealt with.

A large part of the book comprises the various test methods and their interpretation. Temperature controlled test methods such as differential thermal analysis (DTA), differential scanning calorimetry (DSC) and thermogravimetry (TG) as well as isothermal tests such as isothermal storage, isothermal DTA and TG are discussed in detail. These tests are complemented by dewar test methods at normal and elevated pressures, gas evolution and pressure rise tests as well as deflagration and detonation tests.

In the following chapters a large number of exothermic reactions, in particular decomposition reactions but also other primary and secondary reactions, are dealt with in detail making use of the above test methods for various conditions and substances. This material not only gives an indication of the range of substances which may constitute a thermal hazard but also a good account of the wide range of information contained in the literature including the author's own achievements. Of particular interest to those who have responsibility for safety in the chemical industry is the chapter which discusses the various incidents having occurred. In 16 case histories the causes which have led to these incidents, mainly in the chemical industry, are described in detail.

The two concluding chapters consider the more practical problems to determine the practical conditions for a runaway reaction to occur, to identify the thermal hazard and to provide suitable protective measures, for instance emergency relief systems. The book concludes with a table containing the safety characteristic data of 177 substances.

The monograph of Grewer is an outstanding account of the state-of-the-art in controlling thermal hazards of chemical reactions. It reflects the long-standing experience of the author in safety related problems in the chemical industry. The book is written in a clear and concise form and is well illustrated by tables and figures. Thus the book is of great value and particular interest to all chemists, chemical engineers and physicists who are interested in process safety in the chemical and other process industries.

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Landolt-Börnstein Numerical Data and Functional Relationships in Science and Technology, New Series, Group IV: Macroscopic Properties of Matter, Editor in Chief: W. Martienssen Vol. 8 Thermodynamic Properties of Organic Compounds and their Mixtures

Editor: K.N. Marsh

Subvolume A Enthalpies of Fusion and Transition of Organic Compounds

Authors: Z.-Y. Zhang, M. Frenkel, K.N. Marsh, R.C. Wilhoit

ISBN 3-540-58854-x; pp 588; Springer Verlag Berlin 1995

Price: 3375 DM

Springer Verlag continues the renewal of its famous 6th Edition from the 1950s and has found experts from the Thermodynamics Research Center at the Texas A&M University to prepare the above mentioned volume. Besides this first subvolume A on Enthalpies of Fusion and Transition of Organic Compounds, further subvolumes — B on Densities of Aliphatic Hydrocarbons: Alkanes, Alkynes, and Alkenes, C on Vapor