

Technical Information Sheet No 30

A Structured Integrated Safety Test Programme and the Accelerating Rate Calorimeter

Whilst the central aim of the Accelerating Rate Calorimeter is to give an accurate simulation of an exothermic reaction from a single experiment, often full information on a possible runaway of desired or undesired reactions cannot be obtained by just this test. To define the safety of a material or process more information is needed.

Further information is required, this may be by further testing or by e.g. literature searches or computer simulations. A structured, integrated test programme is a useful basis for a safety evaluation of any material, its processing, storage or transportation. Many such schemes have been devised and many published. They are referenced here and not further discussed. However there is a common theme:

Literature study - determination of known, published hazards, information from manufacturers, on line searches, databases, definitive text books.

Oxygen balance calculation - thermodynamic considerations, CHETAH, consideration of structural groups.

Screening tests - in-house simple tests, DSC, specific heat measurement, bomb calorimetry, pressure DSC, dewar, confinement testing.

Accelerating rate calorimetry testing

Additional calorimetry - isothermal age accelerating rate calorimetry tests, reaction calorimetry.

These are tests for thermal hazards, runaway self-heating reactions. Depending upon what may be concluded at each stage more or less testing may be needed. But in addition to this there is the need for.....

Sample considerations: effect of impurities, variation from suppliers, quantity to be used, mixing effects.

Other hazards: flammability, flash point, auto ignition, dust explosion, friction sensitivity, toxicity, environmental fate.

Additional testing indeed would be necessary in the area of other hazards to quantify these hazards. The references cited illustrate how some major Chemical Processing Industries have devised their safety strategy; but this is best tailored to suit the needs of the individual organisation.

- Ref. 1 Girelli A & Cardillo P Rev Combust, 36, 304 (1982)
- Ref. 2 Kohlbrand H T Chem Eng Progress, April 1985, 52 (1985)
- Ref. 3 Seyler R J Thermochimica Acta, 41, 55 (1980)
- Ref. 4 O'Brien G J et al Chem Eng Progress, April 1985, 46 (1985)
- Ref. 5 Nolan P & Barton J Runaway Reactions Symp, London 1989
- Ref. 6 Gibson N Runaway Reactions Symp, London 1987