

Correlating Explosive Properties to DSC Parameters

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ABSTRACT

The use of differential scanning calorimetry (DSC) as a screening method for explosive properties of chemicals has been investigated. Detonation, deflagration, and heating under confinement test methods for classifying energetic chemicals for transportation are specified by UN Recommendations, which now include decomposition energy screening criteria. Based on data from a few energetic compounds, it has been demonstrated by Yoshida et al.

(Safety of reactive chemicals and pyrotechnics, T Yoshida, 1995) that on a logarithmic plot of DSC parameters, energies of reaction (-DH) and extrapolated onset temperatures (To), a straight line can distinguish between benign compounds and compounds capable of detonating or deflagrating. This correlation has been recently investigated by Bodman (Use of DSC in Screening for Explosive Properties, G. T. Bodman

NA TA 5, 2002), with the aim of using DSC data to estimate the explosive potential of a material and, thus, reduce requirements for additional tests. The onset temperature of a compound is a single point on the DSC curve, and we believe that by incorporating more information from the DSC curve, such as peak height, peak width, and aspect ratio, a better correlation with explosion data can be found. The objective of this paper is to investigate relationships between the UN Gap test, Koenen test, time pressure test, and various DSC parameters. Our results indicate that DSC parameters can be effectively used to screen chemicals for the UN tests. For enhanced confidence in the indicated threshold values, these correlations must be tested with data from additional systems.