

USE OF THERMAL ANALYSIS IN COMPATIBILITY TESTING OF
2, 4, 6-TRINITROTOLUENE

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Thermal analysis has proven a usable screening method in compatibility testing of explosives. In the present investigation the use of simultaneous DTA/TG in compatibility testing of 2,4,6-trinitrotoluene with two epoxy- and two alkydresinpaints is described.

Most explosives may be seriously sensitized by some foreign materials. It is therefore important precisely to know whether the material for example paint or glue used in contact with the explosive is compatible with it. Thermal analysis has proven a valuable tool in these compatibility tests [1,2]. Especially the use of simultaneous DTA/TG allows a rapid and quite reliable compatibility evaluation.

In the present investigation the use of the method in compatibility testing of a common military explosive 2,4,6-TNT with two alkyd- and epoxyresinpaints is described.

EXPERIMENTAL

Materials

2,4,6-trinitrotoluene /TNT/ was supplied by Oy Forcit Ab, Hanko. The freezing point of this TNT-grade was 80.4°. The epoxy- and alkyd paints were supplied by Teknos Oy, Helsinki.

Method

The treatment of the paint before thermal analysis was as follows: the paint was dried on a glass plate, scraped off with

a knife and ground in a mortar. The fraction 0.5-1.0 mm was collected and used in analysis. The TNT-sample also had the same particle size.

Thermal curves were recorded of pure TNT and a mixture of TNT and paint. Several ratios of the components were tried.

DTA, TG and DTG curves were recorded simultaneously with Netzsch STA 409 thermal analyzer in dynamic nitrogen atmosphere (60 ml/min). The samples were packed in platinum crucibles and to minimize weight loss due to evaporation of molten TNT the sample was covered with a layer of alumina which also was used as reference material.

RESULTS AND DISCUSSION

Figure 1 shows the thermal curve of pure TNT. The characteristic features of the DTA curve are the melting endotherm at 80° and the very strong exotherm at 270° . The TG curve reveals that a small weight loss due to evaporation happens soon after the melting point. At about 250° TNT decomposes very fast.

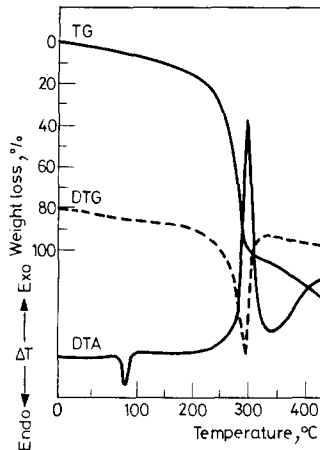


Fig. 1. Thermal decomposition of 2,4,6-TNT

Figure 2 shows the thermal curves of mixture of TNT and epoxy paint 1 in the ratio of 70 to 30. The marked lowering of the onset temperature of the decomposition reaction seen on the DTA curve indicates that thermal stability of TNT gets worse under the influence of this paint. The same is true also with the other epoxy paint /see Table 1/.

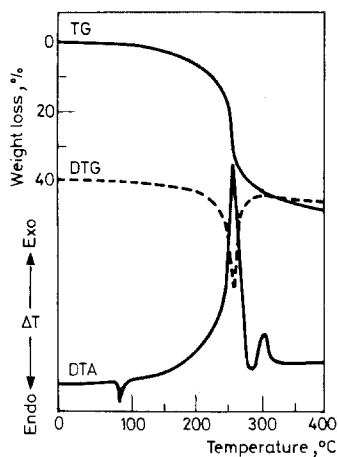


Fig. 2. Thermal decomposition of the mixture of TNT and epoxyresin paint.

The thermal curve of TNT is not very much affected by either of the alkyd paints /see Table 1/.

Table 1

Changes in the critical temperatures of TNT-decomposition under the influence of different paints

Sample	TG, °C		DTA, °C		
	T _{ekstr. Onset}	T _{max}	T _{Onset}	T _{ekstr. Onset}	T _{max}
TNT	245	275	237	260	275
TNT + epoxy paint 1	-16	-16	--140	-24	-17
TNT + epoxy paint 2	-29	-31	--140	-30	-29
TNT + alkyd paint 1	-18	- 5	- 43	- 7	-10
TNT + alkyd paint 2	- 9	- 7	- 29	+ 5	- 1

REFERENCES

1. J. Harris, *Thermochim. Acta* 14/1976/183.
2. G. Krien, 1st Symposium on Chemical Problems connected with

the Stability of Explosives, 66/1967/, "Über die Anwendungsmöglichkeiten und Grenzen der Differentialthermoanalyse und der Thermogravimetrie bei der Prüfung von Explosivstoffverträglichkeiten".

ZUSAMMENFASSUNG - Die thermische Analyse hat sich als eine geeignete Screening-Methode zur Kompatibilitätstestung von Sprengstoffen erwiesen. In der vorliegenden Untersuchung wird die simultane Anwendung von DTA/TG zur Kompatibilitätstestung von 2,4,6-Trinitrotoluol mit zwei Epoxy- und zwei Alkysharzfarben beschrieben.

Резюме - Доказано, что термический анализ является удобным проверочным методом в испытании совместимости взрывчатых веществ. В работе описано использование совмещенного метода ДТА и ТГ для испытания совместимости 2,4,6-тринитротолуола с двумя эпокси- и двумя алкидсольными красками.