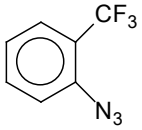
Study of the reactivity and stability of organic azides by calorimetry coupled with gas analysis

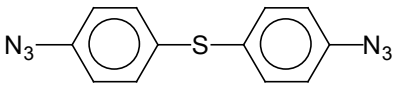
Reference: Studio della reattività e della stabilità di azidi organiche – L. Gigante - Stazione Sperimentale per i Combustibili – MILAN - ITALY

Introduction

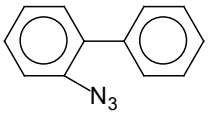
Organic azides are involved in fields as different as the vulcanization of rubber, the treatment of glass fibers, or can be used by themselves as antihypertensive or sedative (bio-pharmacy), or as an alternative to nitro compounds (energetic materials). This last application shows how important it is to collect thermal hazard information about these compounds.



o-Trifluoromethyl phenyl azide



Bis (4-azidophenyl) sulfur



o-azidobiphenyl

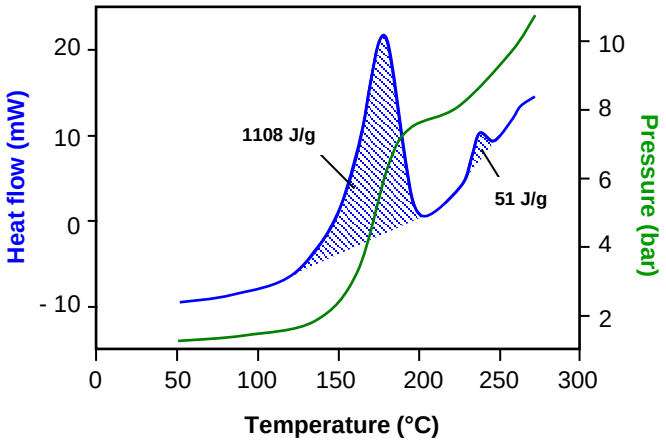


Figure 1 – Heat flow and pressure signals during the decomposition of o-trifluoromethyl phenyl azide

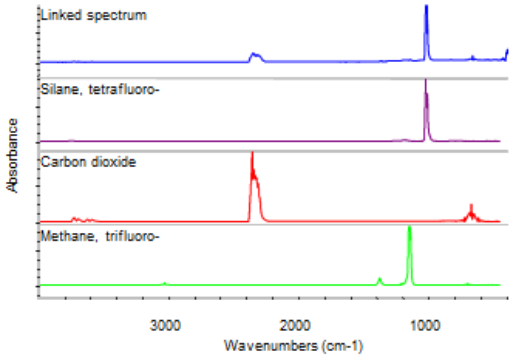


Figure 2 – FTIR spectrum of the gases evolved after the decomposition of o-trifluoromethyl phenyl azide

Experimental

The above experiments was conducted on a C80 at a heating rate of 0,5 K/min between room temperature and 280 °C. 76 mg of sample where placed inside a glass liner perfectly fitting the C80 high pressure measurement cell. The C80 was then cooled down, and the permanent decomposition gases were sent to a gas analyzer cell (FTIR).

Results and conclusions

The complex two-step decomposition of o-trifluoromethyl phenyl azide was studied thanks to a combination of calorimetric, pressure, and evolved gas analysis data. Not only thermal and pressure hazards can be assessed, but also the risks linked with the formation of toxic gases – or straightforward information about decomposition mechanisms. For example, the strange silane – based gas detected by the FTIR was assigned to a reaction between the sample and the glass liner.

This work was done by the Stazione Sperimentale per i Combustibili

C80
Ambient to 300°C