COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS AND ON THE GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS

Sub-Committee of Experts on the Transport of Dangerous Goods

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LISTING, CLASSIFICATION AND PACKING

Transport of Nitroguanidine, wetted, (UN 1336) in flexible IBCs

Transmitted by the International Council of Chemical Associations (ICCA)

Introduction

In document ST/SG/AC.10/C.3/2006/52, ICCA proposed to allow the transport of Nitroguanidine, WETTED with not less than 20% water, by mass (UN 1336) in flexible IBCs under certain provisions. This proposal is based on extensive testing, including test series 6, which led the German Competent Authority to conclude that "Nitroguanidine, wetted with not less than 20% water by mass, packed in a flexible type 13H3 IBC with lattice box, satisfies the criteria of UN Test 6 (c) for exemption from Class 1" (see Annex 1 and 2 of aforementioned document). The report stresses that a water content of at least 20 %, by mass, must be ensured for the duration of the transport, and that the water must be homogeneously distributed within the substance.

General considerations for desensitizers

Although the homogeneous distribution of the diluent is contained in the definition of solid desensitized explosives (see UN Model Regulations, chapter 2.4.2.4.1), the matter seems worth further discussion:

For water or alcohol as a diluent, there are two possible ways of acting as a desensitizer for the explosive substance:

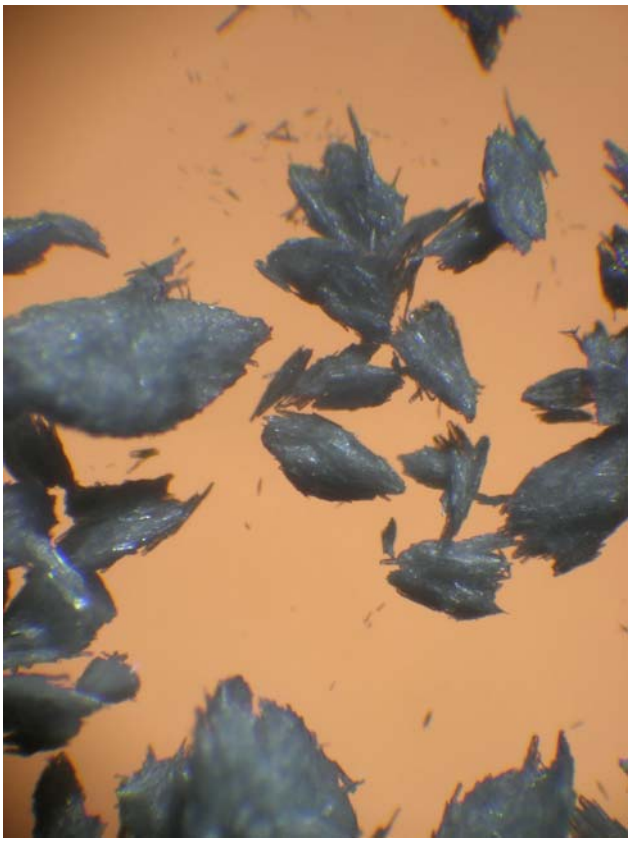
1. The water or alcohol is chemically bound (e. g. as a hydrate)
2. The diluent forms a physical mixture with the substance and is distributed in-between the crystals, for example by adhesion effects.

In case 1, the diluent forms a new chemical compound with the substance. This compound has a well-defined composition and, as such, a very homogeneous nature. Since the diluent is incorporated in the crystal structure, it cannot be detected microscopically.

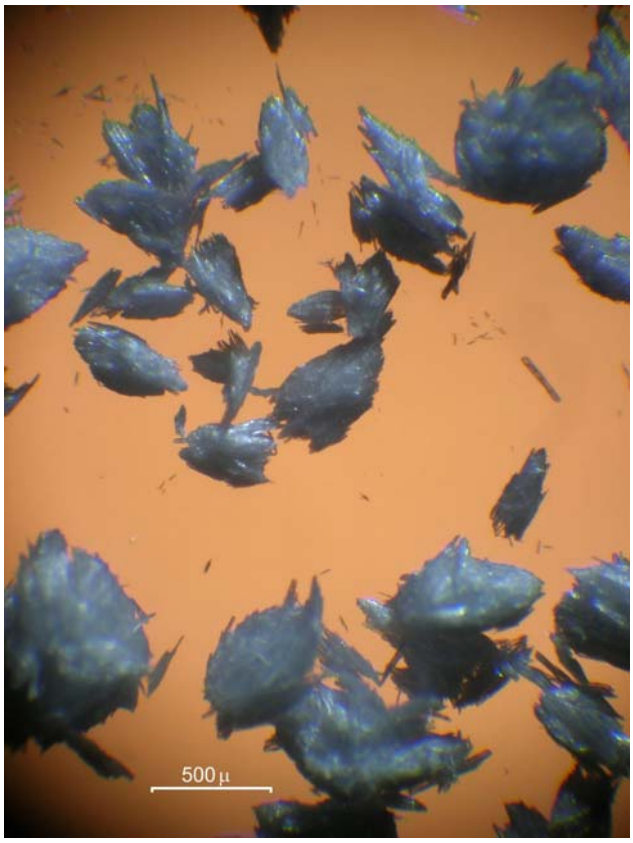
In case of physical mixtures (type 2), the binding forces between the solid and the diluent are much smaller than in case 1. Therefore, one has to check that the diluent remain homogeneously distributed or, at least, its content stay above the required border value for the duration of the transport, especially in view of the mechanical forces to be expected, i.e. e. gravitation and rocking, shaking or friction.

Properties of wetted Nitroguanidine

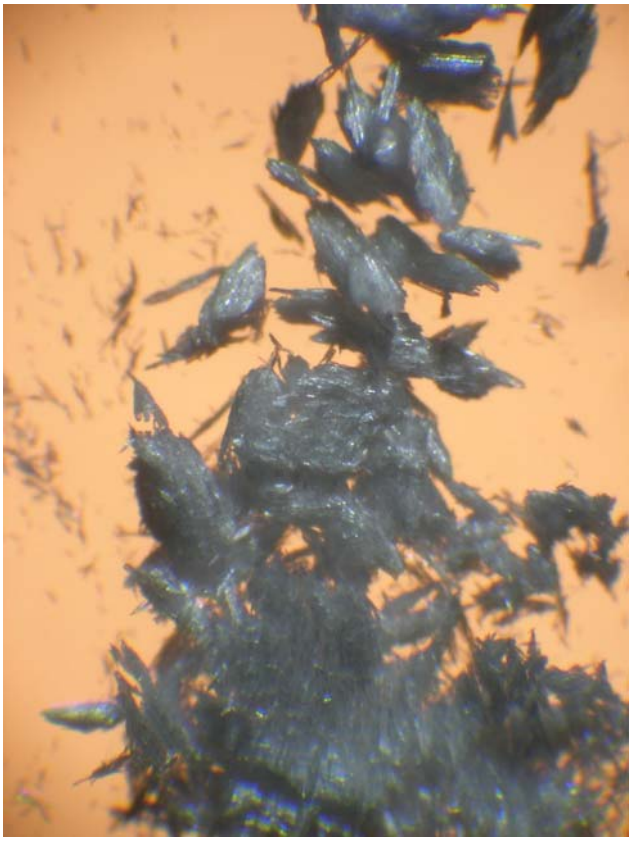
Nitroguanidine does not form hydrates with water. Therefore, the material of UN 1336 is of type 2 as characterized above. Dry Nitroguanidine consists of small needles which tend to form clusters (typically about 500 µm long and 100 µm diameter). This material does not contain any water on the crystal surface, rather the water is absorbed within the clusters. Due to the large inner surface, the overall adhesion forces are rather strong. Therefore, the material does not feel moist and is capable of free flowing (see pictures 1 through 4). The wetted Nitroguanidine will not loose any water under mechanical pressure (weight) of 1 kg on an area of 10 cm by 10 cm. Also, water will not separate out by mechanical stress like rocking or shaking.



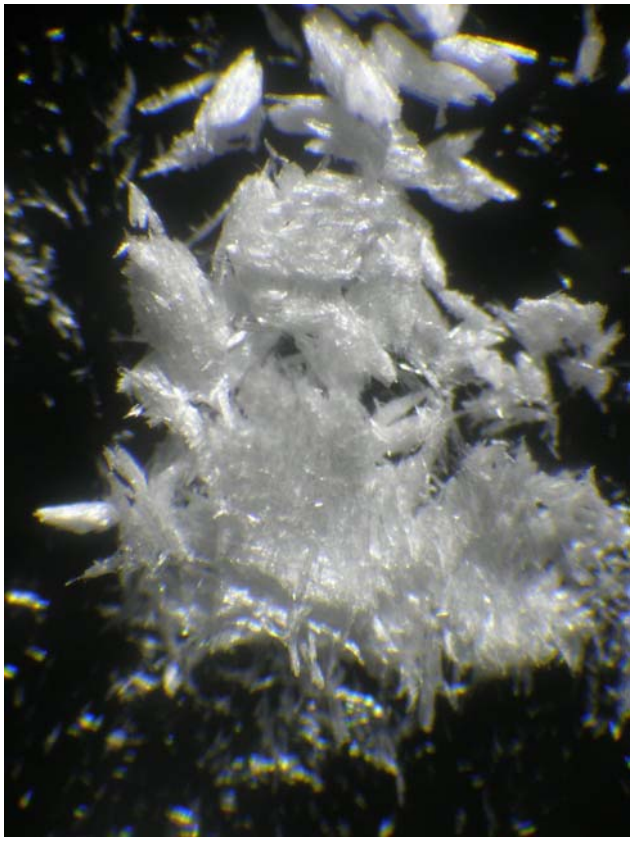
Picture 1: Nitroguanidine, dry



Picture 2: Nitroguanidine, dry



Picture 3: Nitroguanidine, wetted with water

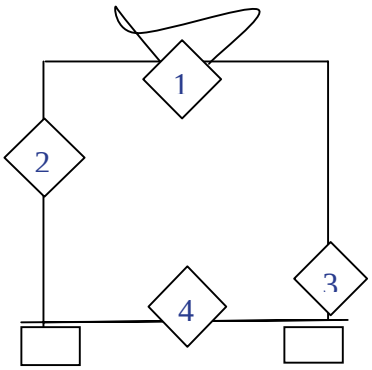


Picture 4: Nitroguanidine, wetted with water

Storage tests

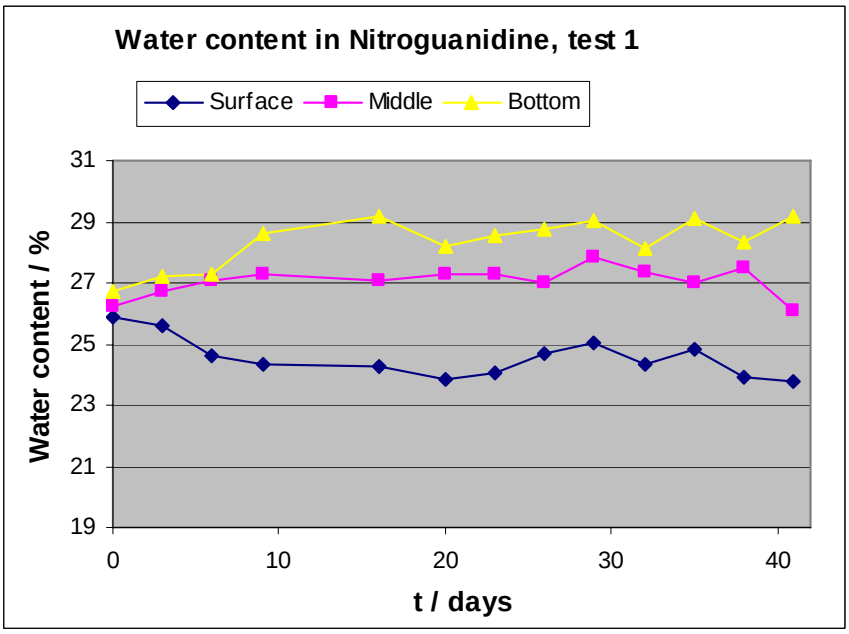
To verify these properties, several storage tests have been performed:

A wood pallet with an FIBC was placed in a warehouse at an ambient temperature of 10 to 30 °C for about 3 months. Samples were taken at the positions shown with the results given in table 1.



Sample No	% water, by mass *)	Date
Average	26,8	2005-03-17
1	27,7	2005-03-18
2	28,5	2005-03-18
3	29,0	2005-03-18
4	27,4	2005-03-18
1	26,7	2005-04-21
2	26,9	2005-04-21
3	28,6	2005-04-21
4	28,9	2005-04-21
1	22,4	2005-06-03
2	27,5	2005-06-03
3	28,8	2005-06-03
4	28,6	2005-06-03

Table 1: Storage test of nitroguanidine, wetted with water

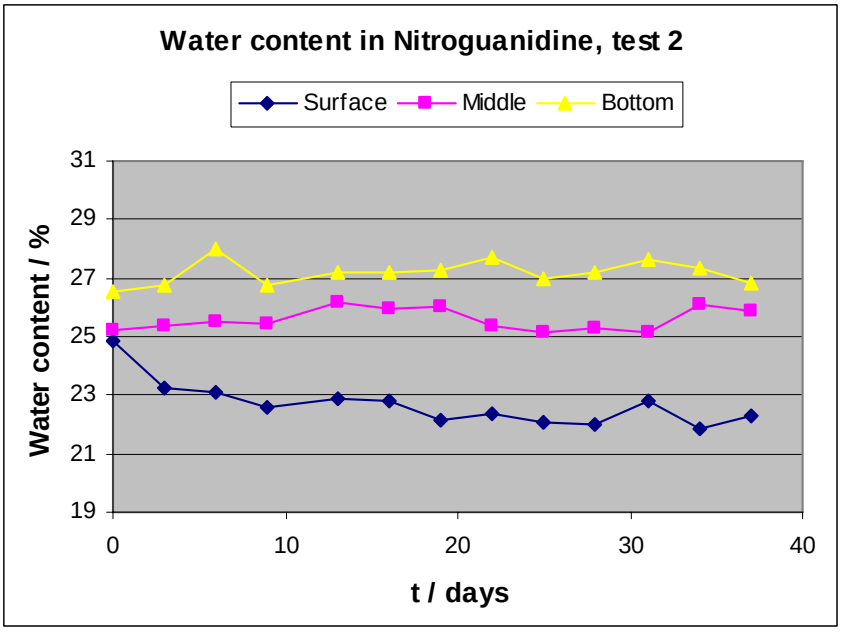


Graph 1: Nitroguanidine water content as a function of time (1)

In a second test series, two other FIBCs of water wetted Nitroguanidine were stored under similar conditions, however, the water content was monitored regularly. The corresponding diagrams are shown in graphs 1 and 2.

Both test series show very similar trends with respect to the water content: At the bottom of the FIBC, the water content increases, and the top it decreases.

After about three weeks, the systems seem to have settled, and the individual values oscillate around a final limit. From the evidence given, it can be concluded that this material will fulfill the requirements with respect to the water content in terms of homogeneity and long-term stability.



Graph 2: Nitroguanidine water content as a function of time (2)

Testing: suggestion of appropriate criteria for approval

The outlined properties of wetted Nitroguanidine should be verified on the basis of test results. The tests should be performed with the authentic substance in the intended type of FIBC. The water content may be determined by Karl Fischer titration or by weight loss (2 h at 100 °C); both methods give similar results with the latter tending to give slightly smaller values than the former. The FIBC should be stored in a warehouse for a period of three months at ambient temperatures. Samples should be taken in a vertical profile (bottom – middle – top) about once a week.

The material is acceptable and the criteria for a transport in an FIBC fulfilled if the water content for each position of the vertical profile

- shows an asymptotic behavior as a function of time and
- this value is above 20 %, by mass.