

## **TKX-50 – A NEW HIGH EXPLOSIVE, DEVELOPED AT LMU MUNICH**

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Hexogen (RDX) was developed in the period 1920-1940 and is today the most widely used chemical explosive in the military field. In 2011/2012 our chair first patented and published TKX-50. Since then, 324 publications about TKX-50 have appeared, including 25 by the Klapötke chair and the rest worldwide, specifically from China, India, USA, Russia and South Korea.

TKX-50 is much less sensitive than RDX, making it safer to handle. For example, the impact sensitivity of TKX-50 is 18J (RDX: 7.4J) and the shock wave sensitivity is 6.2 GPa (HMX: 3 GPa). This makes TKX-50 about two and a half times less impact and only half as sensitive to shock as RDX. Regarding the shelf life, it could be shown that the decomposition rate under Central European conditions after 10 years is about 0.0005% (slightly better than RDX). The thermal stability of TKX-50 is also very good ( $T_{\text{dec}} = 220^{\circ}\text{C}$ ; RDX  $213^{\circ}\text{C}$ ).

On the other hand, the detonation performance of TKX-50 is superior to that of RDX, surpassing it in terms of detonation velocity (TKX-50: 9649 m/s; RDX: 8877 m/s) and detonation pressure (TKX-50: 37.1 GPa; RDX: 34.5 GPa), each at maximum density.

The company TDW Gesellschaft für Verteidigungstechnische Wirksysteme mbH, has also published the following in its patent:

For a pressed composition explosive/wax (94.5%) TDW obtains a detonation velocity of:

9020 m/s for TKX-50

8540 m/s for HMX.

It was also recently shown that TKX-50 is interesting as a high-performance explosive in the field of thermobaric systems. Here it could be shown that the maximum overpressure in aluminized charges is approx. 30% higher than in non-metallized mixtures.

While RDX is acutely toxic and considered a human cancer suspicion, TKX-50 is neither acutely cytotoxic nor mutagenic and therefore not a cancer suspicion.

TKX-50 (about €200/kg) is currently about 10 times more expensive than RDX (about \$ 25/kg), but on the other hand costs much less than CL-20 (Hexanitroisowurtzitane), a high-performance explosive developed in the USA, but which has not yet been used due to its high sensitivity and phase transition issues.