

NOVEL SYNTHETIC APPROACHES TO NITROIMIDAZOLES: NEW CLASS OF  
INSENSITIVE EXPLOSIVES

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In modern ordnance there is a strong requirement for explosives having good thermal stability, impact insensitivity and explosive performance. However, these requirements are somewhat mutually exclusive. Those explosives having good thermal stability and impact insensitivity exhibit poorer explosive performances and vice versa. In an ongoing program to develop new and improved explosives and propellants, we have identified several nitro imidazoles as possible potential candidates for applications in insensitive munitions. During the course of our work on nitroimidazoles, we discovered that 2,4-dinitroimidazole (DNI), while possessing good thermal stability and impact insensitivity, is about 15-20% more energetic than 1,3,5-triamino-2, 4,6-trinitrobenzene (TATB), which is an important insensitive explosive with relatively low energy output. In addition, we also found that DNI is thermally more stable than HMX (1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane), and much less sensitive than RDX (1,3,5-trinitro-1,3,5-triazacyclohexane), which are high explosives extensively being used at the present time.

However, based on performance data we found that DNI does not provide sufficiently high energetic performance in order to replace RDX and HMX in some applications. Therefore, there is a continuing need for new explosives, which are powerful, yet resistant to accidental and sympathetic initiation. To achieve this goal of preparing high energy materials with relatively low sensitivity properties we have designed several synthetic strategies to prepare trinitroimidazoles and substituted trinitroimidazoles. Synthesis of 2,4,5-trinitroimidazole was achieved by two different routes. However, isolation of the trinitroimidazole as a neat product for thorough characterization proved to be elusive. Thus, trinitroimidazole was isolated and characterized completely as its corresponding organic/inorganic salts. In order to overcome the difficulty in isolation of trinitroimidazole as a neat product, functionalization of trinitroimidazole was pursued and several amino-substituted nitroimidazoles were synthesized. 1-amino 2,4-dinitroimidazole 1-amino4,5-dinitroimidazole and isomers of amino and methyltrinitroimidazoles were synthesized . Novel synthetic approaches to several substituted trinitroimidazoles will be presented.