Reduced sensitivity (RS) variants of high explosives have created much interest for applications in insensitive munitions as they offer the potential to reduce the susceptibility of munitions to sympathetic reactions on detonation donor and other shock-based threats. When using such RS-variants the question arises, if a reduced sensitivity is affected by aging or may even help preventing aging mechanisms. On the analytical side lot of work has been done at the crystal level with the aim to distinguish RS- from conventional qualities. At the Fraunhofer ICT X-ray diffraction tools were developed and refined for the purpose of quantifying and assessment of the internal crystal qualities of high explosives and even of coarse crystalline powders embedded in a matrix such as a plastic bonded explosive (PBX) [1]. The methods are applied for the investigation of the aging behavior of a reduced sensitivity RDX compared to a standard quality of RDX.

Coarse and fine samples were aged up to 30 days and 90°C in air and argon. The samples were investigated together with the line and position standard reference material SRM 660a of the National Institute of Standards and Technology NIST by means of X-ray diffraction; measuring 2θ scans of fine powders but ω scans of coarse powders (rocking curves) on seven selected reflection conditions. The 2θ scans were evaluated using double Voigt size/strain analysis implemented in the program TOPAS from Bruker AXS. The rocking curves were evaluated by pattern decomposition using the peak fit and Pearson VII analytical function of TOPAS. Peak width distributions and median peak widths X50 deduced from peak fit data were used as a measure for internal crystal quality or relative microstrain of the RDX crystals [2].

The investigations revealed remarkable reduced microstrain, particularly in the coarse reduced sensitivity RDX compared to the standard quality, which is further enhanced during the aging process. During the storage at 90 °C the reduced sensitivity RDX even gains from the heating period, most likely due to healing of internal defective areas, but the standard RDX undergoes further microstrain and crystal damage. This holds also for the fine powders but less pronounced and in case of the standard RDX less conclusive. However, when applications in PBX are considered, coarse crystals dominate the sensitivity, and thus play the main role for aging or quality assessment. Further evaluations are in progress including the aging behavior of coarse crystals in argon atmosphere, but will also include the behavior of particles in a binder or even a real PBX.