

# MICRO STRAIN IN HMX INVESTIGATED WITH POWDER X-RAY DIFFRACTION AND CORRELATION WITH MECHANICAL SENSITIVITY

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The mechanical sensitivity is an important issue for energetic materials and explosives, which has been discussed as a function of lattice defects originated during crystallization. An approach is made to quantify lattice defects in energetic materials with XRD. Samples of HMX were crystallized under varying conditions to provide different defect concentrations. The samples are investigated with X-ray diffraction and the mechanical sensitivities were measured according to BAM.

As the relatively large crystals obtained by the crystallization procedures are not suited for common X-ray diffraction, measurements with different diffraction geometries were carried out, to overcome problems caused by uneven sample surfaces and poor orientation statistics. Measurements with a Guinier diffractometer with transition geometry equipped with copper tube, Johannson monochromator, Soller slits, position sensitive proportional counter (PSPC) and rotating sample holder therefore succeeded and provided a high peak resolution with a FWHM of  $0.053^{\circ}2\theta$  for the silicon (111)-reflection combined with high intensities.

The data obtained by the diffraction measurements were evaluated with Williamson Hall plots [1] revealing the micro strain for each sample, and the mechanical sensitivities were plotted versus the micro strain. The plots show that micro strain effects decreasing sensitivity against friction. The effect may be explained by the mobility of defects as dislocations causing a better plasticity and therefore lower vulnerability.

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- [1] Williamson G. K., Hall W. H.; X-ray Line Broadening from fcc Aluminium and Wolfram; Acta Metall., Vol 1, 22-31 (1953)