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High energy ionoluminescence of oxide and alkali halide crystals

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The spectral content and emission intensities of the ion-beam induced luminescence in insulators are strongly affected by accumulated radiation damage and associated mechanical stresses. In this report we review the results of recent high energy (1.2-3 MeV/amu) ionoluminescence (IL) characterization of Al_2O_3, Al_2O_3:Cr, MgO and LiF using experimental set-up at FLNR JINR and INF cyclotrons. To evaluate the stress level the well-known piezospectroscopic method, utilizing the relationship between the stress and changes in optical spectra have been used.

Dose dependence of the IL spectra measured from Al_2O_3 during swift Kr, Xe and Bi ion irradiation clear evidences different stages in damage and stress accumulation at fluences before and after ion track overlapping. Contrary, real-time examination of MgO at the same experimental conditions did not reveal the changes in the IL spectra which could be ascribed to mechanical stresses in the irradiating crystals. In-situ studies of of F-type color centers luminescence in LiF followed by postradiation measuremets of depth-resolved lumunescence demonstrated that the luminescence yield is defined by radiation defects formed in elastic collisions in the end-of-range region.