

X-ray Imaging Crystal Spectrometer for KSTAR

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An advanced X-ray imaging crystal spectrometer (XICS) has been developed for KSTAR tokamak. The spectrometer consists of a single spherically bent crystal and a two dimensional (2D) position-sensitive detector. The XICS provides spatially and temporally resolved spectra of the resonance line of helium-like argon (Ar XVII) and the associated satellites from multiple lines of sight parallel and perpendicular to the horizontal mid-plane for measurements of the profiles of the ion and electron temperatures, toroidal rotation velocity, impurity charge-state distributions, and ionization equilibrium. A multi-wire proportional counter with delay-line readout and supporting electronics for the XICS has been successfully utilized to carry out the first proof-of-principle experiment through international collaborations. Although the first principle experiment was proven the photon count-rate of the 2D detector was limited for high density plasmas with intense heating. Recently, a segmented 2D detector to improve the photon count-rate capability was developed and applied to tokamak experiments. The experimental results from the segmented detector and other possible detectors for XICS under the severe experimental conditions include ITER will be presented.