# Current needs and developments in X-Ray Crystal Spectroscopy for ITER

Sanjeev Varshney, Sapna Mishra, Siddharth Kumar and Vinay Kumar
*ITER-India, Institute for Plasma Research, A29, GIDC Sector 25, Gandhinagar – 380016, India*

Robin Barnsley, Gunter Bertschinger, Martin O' Mullane, Philippe Bernascolle
*ITER-Organization, Route de Vinon sur Verdon, CS 90 046, 13067 St. Paul-Lez-Durance, France*

E-mail : sanjeev@iter-india.org

## ***Abstract***

X-ray Crystal Spectroscopy (XRCS) of Hydrogen or Helium like ions of low or medium Z impurities in the plasmas is of significant importance in the nearly 45 planned diagnostics for ITER [1]. The XRCS-Survey [2], a broad-band Bragg spectrometer, is one of the first diagnostic systems which will be put in the group of diagnostics on ITER helping the start-up of the plasma operations. The primary function of this spectrometer will be to accurately measure plasma impurity concentration and their in-flux at ~10 ms intervals in order to reliably operate the machine during all phases of the ITER operations. For profile measurements of important plasma parameters, high-resolution spectroscopy is performed for core [3] and edge plasma through an equatorial port and an upper port of ITER respectively. The XRCS-Edge, a modified Johann spectrometer, is dedicated to measure profiles of ion temperature and poloidal rotation velocity in the plasma edge regions. This spectrometer is mainly required for advanced plasma control and will provide valuable data for edge pedestal physic. These spectrometer systems will have to reliably function in the high radiation environment of the ITER.

The XRCS-Survey and Edge spectrometers are in detailed design phase to meet the ITER requirements. Preliminary performance has been simulated with the impurity emission data modelled with ADAS atomic database and SANCO impurity transport code. The talk will focus on the current design challenges and ongoing developments of X-ray crystal spectroscopy for ITER edge diagnostics and impurity survey including further advances needed in the applicable technology.

**References:**

[1] http://www.iter.org Website of ITER-project
[2] S.K. Varshney, R. Barnsley, M. G. O'Mullane and S. Jakhar, *Bragg spectrometer for ITER*, Rev. Sci. Instrum., **83**, p 10E126-1 - 3, (2012)
[3] P. Beiersdorfer et al, *The ITER core imaging x-ray spectrometer*, Journal of Physics B: Atomic, Molecular and Optical Physics, **43** number 10, p 144008, (2010)