Operation of the upgraded single crystal dispersion interferometer (SCDI-U) and its measurements in KSTAR during abrupt and large density changes

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Disruption is one of the most critical phenomena that can happen in high performance fusion devices, and it must be mitigated. Since the shattered pellet injection (SPI) scheme has been selected in ITER as the basis of the disruption mitigation system [1], it is very important to understand how SPIs affect plasmas, such as electron densities. To measure abrupt and large density changes induced by the SPI, we have developed an upgraded single crystal dispersion interferometer (SCDI-U) system with the laser wavelength of 1064 nm. The SCDI-U system uses only one non-linear crystal (NLC), while other types of DI systems use two NLCs, allowing the SCDI to have a simpler optical setup. Furthermore, the SCDI-U has a completely overlapped beam paths between fundamental and second harmonics beams within the whole beam paths even if it uses an acousto-optic modulator (AOM) to secure large bandwidth of the system, which were not the case in other DI systems with an AOM [2]. In this work, we report its measurements in KSTAR during the SPIs and compare them with those from existing two-color interferometer (TCI) in KSTAR whose wavelength of the laser is 10.6um. The results show that the SCDI-U is more reliable in abrupt and large density changes compared to the TCI. We also discuss its possible application to ITER.

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