

NUMERICAL AND EXPERIMENTAL INVESTIGATIONS ON MULTI-PASS ABSORPTION FOR THE SECOND HARMONIC O-MODE

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ECRH at the second harmonic usually is launched in X mode due to the nearly complete absorption of this mode. However, in plasmas with density near to or above the X-mode cut-off density ($1.25 \cdot 10^{20} \text{ m}^{-3}$ at 140 GHz), heating at the O2 mode is an option (c.f. [1]). Preparatory absorption experiments are being performed on ASDEX Upgrade.

To cope with the incomplete single-pass absorption of the O2 mode, in-vessel reflectors have been designed to allow 2-pass (or multi-pass) transmission with controlled polarisation and beam parameters. To avoid high thermal loads on this mirror and interaction with the plasma, this mirror should have a geometry as similar as possible to the original wall tile that it will replace. Under this condition it is necessary to design the mirror surface as a holographic phase grating. To allow the reflection of arbitrary polarized radiation without mode conversion, the grating must have high efficiencies for polarization parallel (TE) as well as perpendicular (TM) to the grooves, with negligible phase shift between TE and TM components. Note that such gratings can be used in experiments with incompletely absorbed X3-mode, too.

Grating profiles which fulfill these requirements have been optimized, and samples have been fabricated and characterized. Good agreement with the calculations is found. One of these grating mirrors was manufactured out of graphite and installed in the inner wall of ASDEX Upgrade, opposite to an ECRH launcher. It is designed to reflect the unabsorbed part of the wave back to the launcher. Thus two-pass absorption measurements can be performed by a diagnostic setup completely outside of the vacuum vessel.

Low power absorption measurements of the O2 mode using this setup are being done at present. The design process of the grating mirror will be explained, and results from various samples are shown. Beam tracing calculations using TORBEAM will be discussed, and the diagnostic setup and first experimental results will be presented.

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[1] H.P. Laqua et al, "ECRH Heating Scenarios and In-Vessel Components at the W7-X Stellarator", this conference