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Real-time Two-dimensional Optical Polarization Properties of the Fusion Reactor First Mirror Based on Active Polarized Beams

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With the construction of the next generation of large size Tokamak marked by ITER and the realization of steady state plasma discharge, the first mirror(FM) will become the core of optical elements which will be used in the optical diagnosis system of future fusion reactor. Under the action of plasma, the FM surface morphology, structure and composition, and optical properties will be changed, which seriously affect the optical performance and service life of the FM. FM problem, directly related to the effectiveness of the optical diagnosis system, is an extremely important research topic of the future plasma physics diagnosis. At present, the FM research on optical properties mostly stays on the reflectivity, the polarization properties in nature are little studied. Besides, most researches on FM are performed on a point and off-line detection, and the use of polarized beams to carry out real-time on-line two-dimensional detection of the FM are less. In this manuscript, based on the polarization characteristics of a metal object, the experiment system of active polarized beam detecting FM optical polarization properties was established. The two-dimensional polarization information varieties of the same incident beam reflecting from different FMs, including the degree of polarization (DOP), polarization azimuth (PA) and circular polarization angle (CPA), were in real-time studied. It is found that the two-dimensional DOP and CPA can be used to detect different roughness degree Ra and regular degree of the measured surface, and provide significant basis for further quantitative detection of FM damage degree.

Eligible for student paper award?

Yes

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