Low-temperature plasma removal of deposits from fusion first mirrors

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Within a fusion device the optical component closest to the plasma is called the first mirror. With the device in operation the high energy atoms within the plasma erode the plasma facing material and redeposit it around the reactor. Mirrors suffer this erosion and re-deposition process and it causes degradation in the quality of the signal reaching the diagnostics. Erosion is easily overcome with single crystal or small scale crystal structures but the deposition is substantial and with no easy solution [1].

The proposed method of removal of these deposits is using a low-temperature plasma in-situ in order to maintain reflectivity. This involves creating a capacitively coupled plasma using the mirror itself as the powered electrode. Experiments have been carried out to test this method and they have yielded good results [2]. Due to the toxicity of the beryllium used in the construction of the first wall the majority of experiments have used aluminium oxide as a proxy. It is only recently that experiments using beryllium deposits have been conducted, and in limited numbers. In order to improve the removal process it has become prudent to use computer simulations. The Hybrid Plasma Equipment Model has been used in order to investigate and optimise the deposition removal process through simulating conditions and chemistry as close to the working environment as possible. This has been done in comparison with experimental results conducted in York and gathered from literature. In order to conduct this work a plasma chemistry for beryllium has also been created so that both the aluminium oxide experiments and beryllium experiments can be investigated.

References

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