Difference of deposition/erosion distribution on the first wall panels and test divertor unit in W7-X using colorimetry

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The colorimetry, which corresponds to optical reflection rate measurements, is a useful technique to estimate the wide-range deposition distribution in plasma experimental devices. In this paper, we report that the colorimetry results of the first wall panels and the Test Divertor Unit (TDU) in the Wendelstein 7-X (W7-X) carried out using a compact color analyzer after Operation Phases OP1.2a and OP1.2b.

The colorimetry is a method for simply and extensively obtaining the thickness information of the deposition layer by employing an innovative concept of optical reflection coefficient measurement by color analyzer [1]. Recently, the method has been applied on the in-vessel components of W7-X. The colorimetry results showed deposition layers of 10±6 nm and 25±8 nm on the first wall panels made from stainless steel for OP1.2a and OP1.2b, respectively [2]. The thickness of the deposition layer formed during OP1.2b was 2.5 times larger than that formed during OP1.2a. Here, for the estimation of the thickness, the single layer model was assumed and the reflective indices for the deposition layers were also chosen. In this study, we will report the progress that shows more accurate evaluation of the deposition layer thickness of the steel plates from the sub-divertor region with the post-mortem analysis. Moreover, we also report the colorimetry results of TDU for OP1.2a and OP1.2b. On the TDU with its plasma facing side composed of graphite, different color patterns were clearly observed both in OP1.2a and OP1.2b. The difference suggests the deposition or erosion on the surface of the TDU. In this paper, we will correlate the colorimetry results with laser induced breakdown spectroscopy measurements of the TDU target elements.