DOI: 10.34854/ICPAF.51.2024.1.1.249

DEVELOPMENT STATUS OF LARGE-SCALE COLLECTING MIRRORS FOR DTS ITER *)

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Collecting systems of ITER optical diagnostics contain a significant number of in-vacuum mirrors, which must have high optical stability under conditions of exposure to neutron fluxes (max.) 2.25 10^{12} cm^{-1} s^{-1}, thermal cycling 70-180°C, vibration loads, contamination of the reflecting surface with erosion products first wall - W, Be and their compounds, emergency steam breakthrough (SI) 30-250°C at RH more than 90%. DTS system consists of 7 large-scale in-vacuum mirrors with linear dimensions from 360 to 720 mm and made of 316L(N)-IG stainless steel. The optical design of the collection system involves 5 consecutive reflections, therefore the reflectance of each mirror must be above 90% in the range of 500-1100 nm. The quality of scattered radiation transmission is determined by such characteristics of mirrors as stability of shape and spatial position and spectral characteristics of diffuse and specular reflections. The choice of stainless steel 316L(N)-IG as the mirror material and the developed mounting design made it possible to reduce unwanted deformations of the mirror optical surface under applied loads. Since the reflection of stainless steel is ~60-70%, it is necessary to deposit a highly reflective optical coating. Silver is highly reflective in the visible and NIR regions but is susceptible to corrosion when exposed to H^+ and OH^- ions present in water vapor. The barrier type of protection for the reflective Ag layer was chosen - deposition of a thin multilayer dielectric coating with a total thickness ~ 30 nm. The experiments showed that with the same total thickness of the protective coating, increasing the number of interfaces in the protective coating reduces the drop in reflection after SI, and with 5 layers it is practically absent.

The diffuse reflection characteristics of mirrors are influenced by the quality of surface preparation before deposition. Comparison was made of small-sized 316L(N)-IG stainless steel samples, the surface of which was formed by abrasive polishing, MRF, and DT of a copper layer attached to stainless steel by HIP.

This report was prepared as an account of work for the ITER Organization (Rosatom contract N◦ H.4a.241.19.22.) and supported by Ioffe Institute (Russian Federation state funding assignment 0034–2019–0001).

*) abstracts of this report in Russian