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STATUS OF REFLECTOMETRY DIAGNOSIS IN THE VIEW OF HIGH MAGNETIC FIELD *)

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Reflectometry from the strong magnetic field side of the International Thermonuclear Experimental Reactor (ITER), which is in the responsibility of Russia, is one of the important diagnostics. It is based on probing plasma with microwave waves with polarization transverse to the toroidal magnetic field with various frequencies and analyzing the amplitude and phase of the reflected wave. It is the main diagnostic for measuring the density profile in the main plasma volume, recording the H-mode, and observing peripheral and central plasma instabilities. The determination of average density is an additional measurement. In 2016, refractometry diagnostics, based on propagation through the plasma of an extraordinary wave, was included in the diagnostics. The addition of this diagnostic significantly increased the reliability of the mean density measurement. ITER reflectometry has been developing for more than 20 years and is currently a well-established diagnostic tool. Thus, the design of the vacuum part of the diagnostics were finally determined and agreed with the International ITER Organization (IO). The design of the atmospheric part of the diagnostics are determined at the preliminary design level. To date, the technical design of the in-vacuum part of the diagnostics has been approved. The technical design was approved, waveguide lines were manufactured and supplied to ITER in areas with problems of access and supports of in-chamber waveguide lines. The preliminary project of the atmospheric part of reflectometry and refractometry was approved. The development of control and measuring equipment is at the level of preliminary design. During the work, mock-ups of all the most important diagnostic units were manufactured and tested, including high-curvature waveguide bends, an antenna, stainless steel, Inconel (alloy 718), copper waveguides, secondary windows, a microwave bands combining system and elements of control and measuring equipment. The manufactured model of the secondary window was tested under conditions simulating a fire with a temperature of 1049 ^{0}C for 2 hours. The results showed that the temperature on the window did not exceed 200 ^{0}C and the window successfully passed the test. Since the manufacture of reflectometry elements requires special technologies, the antenna manufacturing processes were qualified using selective laser melting, electroplating inside of stainless and Inconel waveguides with a thin layer of copper, brazing stainless flanges to copper and stainless waveguides, brazing Inconel flanges to Inconel waveguides. The principles of ITER diagnostics for measuring the plasma density profile from a strong magnetic field by continuous frequency scanning were tested during experiments on the T-10 tokamak. Thus, we can conclude that reflectometry diagnostics is ready for the approving of the last technical projects and the subsequent manufacturing and delivery of its components to ITER.

*) abstracts of this report in Russian