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Thermal oxidation resistance of carbon nitride coatings

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In the last few years, ceramics gained more popularity in nuclear fusion applications due to their high insulation properties, heat, and radiation resistance when compared to other commonly used isolators [1-3]. Ceramic materials can be used for the elements of plasma facing (i.e., in diverters and as insulation coating of coils) or for the construction components of tokamaks [4]. In the first case, the materials are permanently exposed to different types of ionizing radiation generated inside the fusion chambers and they should possess certain properties; on the other hand, in the second case, the irradiation will be applied just in case of emergency and the properties should be different than those necessary for constant exposure [5].

The DSC measurements were carried out using the DSC3 STAR^e Systems manufactured by METTLER TOLEDO. The standard adiabatic calorimetry was performed in the temperature range of 300 K up to 1000 K at a heating rate of 5 K/min in an argon atmosphere at a flow rate (20 mL/min) and which is previously calibrated with indium. The cooling process was achieved with the help of the NITROGEN UN 1977 REFRIGERATED LIQUID analyzer cooling system and “digital temperature controller”.The error of weight determination did not exceed 1.02 % at 300 K and 1% at 1000 K [6]. It has been determined that during an isothermal process, the heat capacity of the TiNbCN coating remains constant in the temperature interval of 25°C to 600°C, with C/N ratio values of 0.6 and 1.6. In the TiNbCN(C/N=0.6) coating, the central peak at 590°C is observed in the heat capacity curve during both heating and cooling processes. Simultaneously, in the TiNbCN(C/N=1.6) coating, the central peak of the effect is characterized by broadening and deep endo- and exothermic effects. Furthermore, thermodynamic functions of the TiNbCN coating have been determined within the temperature range of 25°C to 600°C.

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