symmetry

Editorial

Editorial for Special Issue "Symmetry in Physics of Plasma Technologies II"

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The success of the Special Issue (SI) "Symmetry in Physics of Plasma Technologies" https://www.mdpi.com/journal/symmetry/special_issues/Symmetry_Physics_Plasma_Technologies (accessed on 1 April 2024) indicated the relevance of its continuation, the contents of which are briefly outlined in [1]. In this paper, we briefly outline the contents of the SI "Symmetry in Physics of Plasma Technologies II".

This SI collected articles on various topics stated in the invitation, including plasma-facing components for controlled thermonuclear fusion (CTF) reactors, plasma processing of materials, plasma chemistry, acceleration of plasma and plasma thrusters, and symmetry issues in the physics of plasma production.

This SI opens with a review article [2] devoted to a comparative analysis of spectroscopic studies of tungsten and carbon deposits on plasma-facing components (PFC) in thermonuclear fusion reactors. Specifically, most attention has been paid to the diagnostics of deposits produced by axisymmetric toroidal magnetized plasma in the T-10 Tokamak and plasma flows of the QSPA-T Plasma Coaxial Accelerator. This comparison is particularly interesting in light of the ITER Organization's recent decision to use tungsten as a PFC not only in the divertor of the ITER tokamak (https://www.iter.org/, accessed on 1 April 2024), but also in the main vacuum chamber. Because the CTF program has accumulated an extensive database on working with carbon PFCs using a graphite first wall in many facilities, the comparison [2] is of great practical interest for ITER. In addition, the breadth and depth of the methods used by the authors render the complex analyses of deposits highly methodologically interesting for various plasma applications.

Article [3] utilizes plasma etching to modify templates produced during the nanosphere lithography-based fabrication of spherical nanostructures. In addition to a detailed description of the manufacturing procedures, the authors provide a conceptual overview of nanosphere lithography. The prepared highly ordered nanopatterned arrays (from circular, triangular, and pillar-shaped structures) are applicable in diverse fields (such as plasmonics, photonics, sensorics, biomimetic surfaces, and life sciences).

Another technology, a plasma torch reactor, is discussed in article [4], presenting the modeling and performance analysis of municipal solid waste treatment. A detailed comparison of the simulation results with the experimental data was performed. The analysis showed that a plasma torch can operate optimally, maintaining a stable flow with a highly efficient heating process. Plasma torch technology has proven to be a promising solution for the disposal of municipal waste in an environmentally sound manner.

Article [5] contributes to studies on the effect of oxygen content in plasma composition on the concentration and size of silicon nanoclusters in amorphous a-SiO_x:H + ncl-Si films using a unique technique of ultrasoft X-ray emission spectroscopy (USXES). Dielectric films containing nanocrystals (nc-Si) and nanoclusters (ncl-Si) of silicon are of great interest to researchers because, due to dimensional quantization, such films can produce photo- and electroluminescence at 300 K. The authors presented the results of complex studies of

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the films, including data on USXES, X-ray diffractometry (XRD), Raman scattering, and Fourier-transform infrared spectroscopy (FTIR).

The next two articles [6,7] shift our attention from plasma chemistry in the laboratory to plasma acceleration in the laboratory and in space.

The laboratory tests of a bi-directional plasma thruster for electric propulsion in space are reported in [6]. Magnetized plasma is created by a source of helicon radio frequency (RF) electromagnetic waves. The results are in good agreement with the general theory of the processes in the magnetized RF plasmas for a bi-directional plasma source. The influence of the magnetic field on the RF breakdown threshold in a multidirectional plasma thruster is theoretically shown.

The issues of symmetry and dimensionality of the plasma configuration during plasma acceleration in the laboratory and in space are considered in [7]. The authors trace the connection in detail between the dynamics of the symmetry of the electric current configuration and the formation of high-speed plasma jets. The experimental results on the formation and evolution of electric current sheets in two-dimensional magnetic configurations with an X-type null line are of interest for plasma acceleration phenomena, ranging from solar flares and other magnetic reconnection events in space to laboratory plasma accelerators and magnetic reconnection in magnetic thermonuclear fusion devices such as tokamak.

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