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Interaction of Hot Plasma and Fast Ion Streams with Materials under Tests in the Dense Plasma Focus Devices and Some Results of the Irradiation

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Dense Plasma Focus (DPF) devices PF-6 (6 kJ) and PF-1000 (1.2 MJ) placed at the IPPLM, Warsaw, Poland, are the main facilities that were employed for tests of perspective materials intended for use in future fusion reactors (FR) like Iter and NIF. Their discharge currents reach very high values up to 0.76 MA and almost 3.0 MA correspondingly that are the record figures for the facilities of their classes. Moreover these machines are equipped with a large number of contemporary and unique diagnostics that allow investigations of processes of irradiation of samples under tests with high temporal, spatial, angular and spectral resolution. During irradiation experiments a large number of parameters are monitored. Among them temporal and spatial evolution of primary (DPF pinch) plasma density, soft and hard X-ray and neutron radiations, angular and spatial distribution of these radiations types together with fast ions and relativistic electrons, as well as the same characteristics for secondary plasma, produced by these penetration radiations at the surface of a solid state target under irradiation. Subsequent analysis of the irradiated specimens includes a number of contemporary techniques that give an information of the irradiated materials' elementary contents, structure and properties. The report discuss results obtained at the irradiation of a number of materials (W, CFC, SiC, Ti, Al, low-activated ferritic steel "Eurofer" and a number of alloys) as well as its subsequent analytical examination with optical and electron scanning microscopy, distribution of elements on the sample's surface before and after irradiation, analysis of damageability of the samples depending on the irradiation parameters and so on.

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