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P5.3006 Temperature regimes of plasma sputtering cell for deactivation of nuclear power plants constructions

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One of the current nuclear industry problems is irradiated reactor graphite deactivation during decommissioning of nuclear power plants, as well as findings of effective method for decontaminating of nuclear power equipment internal surfaces sedimented with radionuclides from reactor water during operation. Important sub-task in this way is removal of the 14C isotope (half-life of 5730 years) from irradiated graphite. Experimental studies of the spatial localization of 14C isotope inside of the irradiated graphite balk [1] showed that considerable amounts of 14C isotope may be concentrated at or in close vicinity under the bulk surface. We propose a new approach for the surface decontamination of irradiated reactor graphite or nuclear power plant structures: nano- and micro-sized radioactive contaminants by sputtering in inert gas plasma discharge and diffusively transferred to the metal collector, the liquid radioactive wastes are not formed, and the radionuclides to be removed are condensed in a compact solid form [2]. The direct current plasma discharge is ignited in argon at a pressure of P ~ 0.1-1 bar, collector flat tantalum plate (as anode of 1 mm thick covered with 10 mm ceramics) is set at 1 mm above the flat surface of the graphite bulk cathode. We have calculated the temperature distribution in three media: graphite cathode thickness 60 cm), argon plasma (1 mm), anode (10 mm). The Table shows the surface temperature of the cathode TK and the anode TA, depending on the discharge input power density and equivalent current density at 600V discharge voltage. The external boundary surfaces of said anode and cathode are cooled and maintained at 300K.

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