1.10 Experimental Study on Plasma-Coated Graphite Interaction①

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The plasma-surface interaction is an important task in the nuclear fusion research. The interaction of plasma on graphite and the coated graphite has been studied by using LAS-2000 mass spectrometer, RF ion source and HL-1M Tokamak. It turned out that: (1) the chemical erosion reaches maximum value at 770 K during the D^+ radiating the SMF-800 graphite of the HL-1M first wall, and the in-situ coating film with boron or silicon can effectively suppress the chemical erosion (about 80% ~90%). The sputtering yield of the H^+ radiating SiC is about one third of that of graphite, ≈0.5 atom/H^+. The thermal desorption substances of in-situ boronized film do not include hydroborons, but the main substances are hydrocarbons. Heating the coated film can decrease the content of a-C : H and improve the property of the in-situ coated film. (2) After the first wall of HL-1M is coated, the high Z metal impurities in plasma almost disappear, C and O are reduced by 70% and 90%, respectively. The hydrogen recycle is also decreased. The wall coating with lithium has the lowest impurities and the lowest hydrogen recycle, but its effective life is the shortest. The plasma radiation and impurities with wall coating by silicon is higher than that with the wall coating by lithium, its effective life is also longer. (3) The SiC and B_4C made by CVD or powder metallurgy have the lower chemical erosion, but its sputtering property and the vacuum property are inferior to that of the in-situ coating film. The study is of benefit to the HL-1M and HL-2A wall condition, and the choice of HL-2A first wall material. The PSI database for Southwestern Institute of Physics is established.

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