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Cryopump development of the 5MW NBI system on HL-2M tokamak

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In order to carry out long pulse and high power NBI heating experiment on HL-2M tokomak, the high pumping speed pump is very necessary, which can rapidly remove the gas load from vacuum vessel, reduce the affect of the background gas in NBI injector on the tokomak plasma and ensure that the re-ionization loss of neutral beam in drift duct is less than 5%, so that a cryopump with large area interpolation plates based on three-stages adsorption structure has been developed. The design idea and size of three stages structure, the manufacturing technique and test experiment of simulated the actual operating mode for cryopump have been described in this paper. Experimental results show that the shielding plates can cool down to 80K when liquid nitrogen is added and cooling time is 1.5 hours, but the adsorption plates can only cool down to 120K by radiation from the shielding plates, the cooling time is 3.3 hours. The adsorption plates and the outlet of helium pipe can cool down to 5K and 6.3K respectively, when liquid helium is added, it takes only 10 minutes. This paper also shows three surface treatment processes to reduce the heat load of adsorption plates. In order to achieve good adsorption effect of hydrogen and deuterium, select the active charcoal whose specific surface area is 1923.92 square meters per gram and micro pore ratio is 94.7%, take twice bonding process, that the total amount of active charcoal can be reached 400 grams per square meter. And finally we obtain that the pumping speed of the cryopump is 2.3 million liters per second, the conductance probability of cryopump interface is 0.39, batter than that of pumps with chevron and louver structure shielding plates, liquid helium consumption is 11.3 grams per second, and several reasons cause of the increase in liquid helium consumption are analyzed.

Eligible for student paper award?

No

Author: Mr YANG, Xianfu (Southwestern Institute of Physics)

Co-authors: Dr CAO, Jianyong (Southwestern Institute of Physics); Dr WEI, Huiling (Southwestern Institute of Physics); Mr LIU, He (Southwestern Institute of Physics)

Presenter: Mr YANG, Xianfu (Southwestern Institute of Physics)

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