

## **Preliminary analysis of breakdown and startup conditions for the first plasma of HL-2M**

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HL-2M is a new tokamak under construction in SWIP. In order to achieve the first plasma on HL-2M successfully, the initial discharge breakdown and start-up conditions are analyzed according to the engineering and physical goals of HL-2M, and the self-consistent initial discharge parameters are designed. In this paper, we will introduce the design of the equilibrium configuration, the compensation of the magnetic field generated by the eddy currents in the vacuum vessel and the plasma breakdown conditions for the discharge in detail. Finally, a self-consistent initial plasma discharge parameters are designed.

In this paper, the limiter equilibrium configuration for the initial discharge of HL-2M is designed by EFIT. And then the divertor configurations with a low elongation are explored to further optimize the plasma discharge control technology on HL-2M.

Since the vacuum vessel of HL-2M is designed to be conductive in the toroidal direction, the eddy current induced in vacuum vessel before and after the breakdown of the plasma will produces a strong vertical magnetic field in the plasma region. The vertical field destroy the pure (regardless of eddy current effects) null magnetic field configuration, which is too bad to the plasma breakdown and plasma current ramp-up. Therefore, this paper will explore the compensation of the magnetic field generated by the eddy current, and then design a self-consistent null-field configuration and give the initial plasma discharge parameters.

A preliminary estimation of the volt-second consumption in the plasma discharge process is made based on the Ejima's coefficient and Spitzer's resistance method. Refer to the plasma startup design on EAST and KSTAR by J.A. Leuer, the self-consistent initial plasma discharge waveform among the plasma current, the PF coil current and the CS coil current are designed. At the same time, the additional currents that compensate for the magnetic field generated by the eddy currents are considered in the evolution of these waveforms.

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