Study of alpha-particle confinement in the LHD type reactor

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Confinement of energetic particle is one of the important issues in the fusion reactor research. High energy alpha-particles (3.5MeV) are produced by D-T reactions, and these energy are indispensable to sustain the high temperature fusion plasma. Also the lost high energy alpha-particle could damege the first wall. Therefore, it is important to confine the high energy alpha-particles until the energy slow-down to the thermal energy. Particularly, in helical systems, high energy particle trajectory is complicated in a three dimensional magnetic configuration and, thus, the confinement of alpha-particles is one of the critical issues in designing helical reactor.

In this paper, we study the confinement of alpha-particles in a heliotron fusion reactor based on the LHD configurations[1]. We analyze the real and velocity space distributions and the loss rate of energy and particles changing plasma beta values and the shift of the vacuum magnetic axis position in the major radius. The GNET (Global NEoclassical Transport) code[2] is used where the particle orbits are followed by the Bulirsch-Stoer methodthe energy and particle and pitch angle scattering effects during the energy slow down are included. It is shown that the and energy loss rates strongly depend on the plasma beta value because of the large configuration changes due to the Shafranov shift. The change of the velocity spatial distribution is also evaluated increasing the beta value.

[1] S.Murakami, et al., Nucl. Fusion **42** (2002) L19.

[2] S.Murakami, et al., Fusion Sci. Technol. **46** (2004) 241.