The confinement and the loss process of the α-particles in the LHD type reactor

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Confinement of energetic particles is one of the important issues in the fusion reactor research. High energy α-particles (3.5MeV) are produced by D-T reactions, and these energy are indispesable to sustain the high temperture fusion plasma. Also the lost high neregy α-particles could damege the first wall. Therefore, it is important to confine the high energy α-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 α-particles is one of the critical issues in designing helical reactor.

In this paper, we study the confinement of α-particles in a heliotron fusion reactor based on the LHD confiurations[1]. We analyze the real and velocity space distributions and the loss rate of energy and particles changing plasma beta value and the vacuum magnetic axis position in the major radius. The GNET(Global NEolassical Transport) code [2] is applied to study the α-particle confinement with the energy and pitch angle scattering during the energy slow down. It is shown that the particle and energy loss rates strongly depend on the plasma beta value because of the large configuration chagnes due to the Shafranov shift. The the velocity spatial distribution is also evaluated and the loss processes of the α-particle is clarified.

[1] S. Murakami, et al., Nucl. Fusion **42** (2002) L19.
[2] S. Murakami, et al., Fusion Sci. Technol. **46** (2004) 241