REACTOR PLASMA DESIGN BASED ON LHD

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The overview of helical reactor concepts and related plasma designs based on the Large Helical Device (LHD) experimental database are described. Firstly, design requirements for helical reactors are clarified with respect to plasma confinement improvement, density limit and beta limit. Several new confinement scaling laws are derived using LHD database in addition to the previous medium-sized helical confinement database. In the previous LHD-type reactor designs two times better plasma confinement time than the conventional LHD scaling law was assumed, which has been already achieved experimentally as "New LHD" scaling laws. One and half times higher plasma density than the conventional helical density limit scaling law has been achieved. This condition is required at the start-up phase of reactors. Higher than half of beta value required in reactors is also achieved in the inward-shifted configuration in LHD experiment, which beta value is beyond the theoretical Mercier stability limit. This inward-shifted magnetic configuration satisfies high beta and low effective helical ripple operations required for reactors. Almost all these normalized requisites have been achieved in the LHD experiment. The present LHD experiment can justify the future prospect of the LHD-type helical devices towards a steady state, efficient and reliable reactor.