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FTP/P7-30: Steady State versus Pulsed Tokamak DEMO

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The present report deals with a Review of problems for a Steady state(SS) DEMO, related argument is treated about the models and the present status of comparison between the characteristics of DEMO pulsed versus a Steady state device.The studied SS DEMO Models (SLIM CS , PPCS model C EU-DEMO, ARIES-RS) are analyzed from the point of view of the similarity scaling laws and critical issues for a steady state DEMO. A comparison between steady state and pulsed DEMO is therefore carried out: in this context a new set of parameters for a pulsed (6-8 hours pulse) DEMO is determined working below the density limit, peak temperature of 20keV, and requiring a modest improvement in the confinement factor(HIPBy2=1.1) with respect to the H-mode. Both parameters density and confinement parameter are lower than the DEMO models presently considered . The concept of partially non-inductive pulsed DEMO is introduced since a pulsed DEMO needs heating and current drive tools for plasma stability and burn control. The change of the main parameter design for a DEMO working at high plasma peak temperatures Te˜35keV is analyzed : in this range the reactivity increases linearly with temperature, and a device with smaller major radius (R=7.5m) is compatible with high temperature. Increasing temperature is beneficial for current drive efficiency and heat load on divertor, being the syncrotron radiation one of the relevant components of the plasma emission at high temperatures and current drive efficiency increases with temperature. Technology and engineering problems are examined including efficiency and availability R&D issues for a high temperature DEMO. Fatigue and creep-fatigue effects of pulsed operations on pulsed DEMO components are considered in outline to define the R&D needed for DEMO development.

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