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# LiWall tokamak regimes and our path to the fusion power reactor

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Since its first formulation in Dec.1998, the LiWall concept has made an outstanding progress is developing the new vision of the magnetic fusion power reactor, its regime, design and development path. It was shown, that a number of fundamental requirements for the power reactor, such as a stable, high-beta operation with a high density of the DT power (10 MW/m$^3$), high wall load (10 MW/m$^2$), efficient power extraction from the plasma (consistent with the plasma facing elements), efficient power conversion into electricity, tritium cycle and control, etc (which is still out of reach by the conventional approach), fits well the LiWall reactor concept.

Concerning the plasma regime, LiWall relies on a low recycling plasma edge and on a high-beta, wall stabilized plasma with the lithium coated surface in a contact with the high-temperature plasma edge. The resulting flat temperature profile eliminates the Troyon beta-limit and the thermo-conduction transport, thus, creating a unique situation, where the plasma control can be performed exclusively by the core plasma fueling.

The present talk addresses the consistency of the LiWall physics with the operational power reactor regime in both small scale (30 m$^3$) demonstration Ignited Spherical Tokamak (IST) device (0.5 GW of the DT power) and in a LiWall tokamak power reactor (R=6.4 m, a=1.6 m, 380 m$^3$ volume, 4 GW DT power). It is shown that the LiWall regime opens a wide parameter space for a reliably stable operation at high-beta with a 100 % (or overdriven) bootstrap current value (calculated by direct numerical simulations of the plasma particle trajectories).

Finally, the apparently unsolvable problem of core fueling, which is fundamental for an entire magnetic fusion, has been resolved in a beautiful way, consistent with the low recycling, high-temperature plasma of the LiWalls. This recent achievement removes the most prominent plasma physics objection against the low recycling LiWall regime. It puts the LiWall in the leading position as a magnetic fusion concept with a practical R&D path to an Ignited Spherical Tokamak demonstration experiment (possible in about 8-10 years), then IST based ignited Component Test Facility (12-15 years) and, finally, to the LiWall fusion power reactor (in 20-25 years).