DIII-D Wall Change Community Forum

Lithium in Tokamaks

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I will make several statements without supporting them by details

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Significant progress in getting \simeq 59 MJ DT energy and Q=1/3 for 5 s

Both JET campaings relied wisely on hybrid regimes with IpI=2.5 MA, Bt=3.9 T

In two decades after a "bad luck" in 1990s with the first attempts in getting Q=1 on TFTR and JET, the Q=1/3 is frustrating.

- 1. The minimal milestone Q =1 was not even in the agenda for DTE2(3) on JET with ILW
- 2. Q < 1 and no prototype regime for ITER is a failure of the entire fusion community in utilizing the best fusion facility, operated by the highly professional team and skillful management
- 3. The entire high recycling approach (complicated, unpredictable and disruptive) failed (as it was expected by many of us in 1998 as well as by DoE)

JET has discredited the present approach. This is a fundamental contribution of this exceptional facility to fusion



It is a huge mistake of fusion community and its agencies (DoE, EuroFusion, UKAEA, China) in considering lithium as incompatible with the burning plasma (probably due to community failure to defend C in the ITER project)

Copyright © May 22,2024. LiWFusion, Leonid E. Zakharov All rights reserved *In contrast, 24/7-LiLi is the only material*

- working as a garbage collector maintaining an excellent vacuum in tokamaks
- capable to pump out plasma with 1 g/s (my, LZ number) safe flow rate
- capable (with fueling by NBI) of suppressing the plasma edge cooling by recycling
- capable to prevent the tritium accumulation in machines with a burning plasma
- consistent with the real time tritium recovery (RTTR) for the reuse by NBI
- eliminating the PSI as it is known now, the major cause of plasma unpredictability
- suggesting the simple plasma regimes, controllable and suitable for disruption avoidance

The present situation is perfect for the private business:

for generating all know-hows of fusion enabling technology with no "tritium", "neutrons", "regulations", and initially "tokamaks" involved



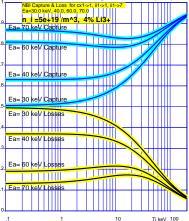
With no Li, DIII-D was the major contributor to our understanding of tokamkak physics and LiWall Fusion, just in the critical time of 1998: discrediting $T_e > T_i$, discovery of DBQH-mode regime, Keif Burrel talk to APS in Quebec city on EHO, RMP, tile diagnostics, SoL currents (Todd Evans, Hiro Takahashi and others)

- We will insist on LTX-β conversion to the first facility with the 24/7-LiLi environment. Nobody has such experiences with Li in tokamaks.
- DIII-D (which does not like Li) should start thinking about a new facility with 24/7-LiLi and $\tau_E \simeq 1 2s$ (?) with recycling suppressed to the residual 5-10 %.
- Then, it will be possible to think about an US facility with DT burning plasma and a nuclear blanket at a special site.
- JET is 95-%-built bridge to the "tokamak-fusion-as-it-should-be". With pure H, D (no T) plasma and 24/7-LiLi installed JET can get $\tau_E \simeq 4-5$ s and generate the design data for He pumping. DIII-D (U?) can, and should, intercept this mission.

Figure. $\langle \sigma v \rangle$ calculations of Cx and Ion Impact ionization with NBI capture exceeding Cx losses for 30, 40, 60, 70 keV H-NBI ($\times 2$ for D-NBI)



Li is a real treasure for tokamaks in many aspects



Leonid E. Zakharov, DIII-D Wall Change Community Forum, June 12-13 2024, online

