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Analysis of Secondary Peak in Hα Emission Profile during Gas Puffing in Aditya Tokamak

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Abstract : Efficient gas fueling is a critical aspect that needs to be mastered in order to maintain plasma density, to carry out fusion. This requires a fair understanding of fuel recycling in order to optimize the gas fueling. In Aditya tokamak, multiple gas puffs are used in a precise and controlled manner, for hydrogen fueling during the flat top of plasma discharge which has been instrumental in achieving discharges with enhanced density as well as energy confinement time. Following each gas puff, we observe peaks in temporal profile of Hα emission, Soft X-ray (SXR) and chord averaged electron density in a number of discharges, indicating efficient gas fueling. Interestingly, Hα temporal profile exhibited an additional peak following the peak corresponding to each gas puff. These additional peak Hα appeared in between the two gas puffs, indicating the presence of a secondary hydrogen source apart from the gas puffs. A thorough investigation revealed that these secondary Hα peaks coincide with Hard X- ray bursts which come from the interaction of runaway electrons with vessel limiters. This leads to consider that the runaway electrons (REs), which hit the wall, in turn, bring out the absorbed hydrogen and oxygen from the wall and makes the interaction of REs with limiter a secondary hydrogen source. These observations suggest that runaway electron induced recycling should also be included in recycling particle source in the particle balance calculations in tokamaks. Observation of two Hα peaks associated with one gas puff and their roles in enhancing and maintaining plasma density in Aditya tokamak will be discussed in this paper.

Keywords : fusion, gas fueling, recycling, Tokamak, Aditya
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