EXPERIMENTS FOR THE HYDROGEN COMBUSTION

ASPECTS OF ITER LOVA SCENARIOS

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This work addresses the hydrogen safety issue of International Thermonuclear Experimental Reactor (ITER) in case of a loss of vacuum accident (LOVA scenario). In this scenario the accidentally generated hydrogen mixed with the injected air could be ignited at reduced, sub-atmospheric pressure. The general question is whether the induced combustion pressure, could exceed the ITER vaccum vessel design pressure. The paper presents the results of large scale dynamic experiments on hydrogen ignition and combustion at reduced pressure in presence of a turbulent air jet injected into the hydrogen atmosphere. Experiments have been performed in a cylindrical vessel with a volume of 8.8 m³ filled with hydrogen at an initial pressure of 200 mbar. Fig. 1 shows a schematic of the ignition process and the interior of the test volume. The orifice size of 6 mm internal diameter was chosen to model the real leak with a 100x100 mm² area in the vacuum vessel with a volume of about 3000 m³.



Figure 1: Schematic of ignition experiments (left) and internal view of experimental facility (right).

The structure and dynamics of air jet into the hydrogen atmosphere at different initial pressures were investigated using microscopic liquid droplets as markers. During the combustion tests, it was found that more distant ignition positions and stronger ignition energy lead to lower maximum flame velocity (within the range 5-25 m/s) and combustion pressure lower than the design pressure.