ABSTRACT

Topic: **Safety analysis of fusion reactors / Hydrogen and dust explosions.**

Characterization of dust mobilization in tokamaks

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A fraction of the dust inventory in ITER can be mobilized in ITER accident scenarios such as an air inlet, contributing to at least two safety issues: *i)* predicted site source term for a given accident scenario due to redistribution and potential release to the environment and *ii)* increased and redistributed reactive surface area available for hydrogen production and explosion potential [1]. Thus, the dusts characterization appears to be crucial: chemical composition, thermal-physical properties, size and mass distributions, surface area/porosity, deposition patterns, adhesive/surface contact behavior, tritium retention… These properties are also essential as input parameters when considering the numerical flow modeling of the mobilization process induced by air ingress, the transport, the chemical reactivity and deposition of these particles [2].

Although many of the dust characteristics can be found in the literature for various tokamak machines (Tore Supra, JET, NSTX…)[3], there are mostly determined with invasive sampling techniques and off-line analysis (MEB, BET…). The problem is that these analyses do not take into account at all the dust mobilization process (the fluid flow/surfaces/dust interaction) which can be considered to be the most relevant one regarding to the two aforementioned safety issues.

To partly solve this problem, we are currently developing an experiment for the non invasive and the on-line characterization of the size distribution and concentration of the dusts mobilized by air ingress. The diagnostic is based on the measurement of the spectral transmission of a electromagnetic beam. This experimental work will be detailed in the paper, as well as a literature review of the studies on the mobilization process (experimental and numerical flow models works), showing the necessity to couple experimental and numerical approaches.

References:

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[3] J.P. Sharpe, D.A. Petti, and H.W. Bartels, A review of dust in fusion devices: implications for safety and operational performance. Fusion Engineering and Design **63-64** (2002) 153-163