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ITR/P5-26: Status of R&D on In-Vessel Dust & Tritium Management in ITER

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In a tokamak, plasma-surface interactions can produce dust. During operation, tritium present in the Vacuum Vessel (VV) can be trapped in VV materials and particularly in dust and co-deposited layers accumulating in the divertor area.
In event of an accident involving ingress of steam into the VV, hydrogen could be produced by chemical reaction with hot metal and dust, particularly Beryllium. In case of ingress of air into the VV, reaction of air with hydrogen and/or dust cannot be completely excluded and could lead to a possible explosion which could challenge the VV (first confinement barrier) tightness. To prevent such accidents and their radiological consequences, limitations on in-VV accumulation of dust and tritium and on air ingress are imposed. Correlatively, ITER has defined a strategy for the control of in-VV dust and tritium inventories based on both measurement and removal techniques. In this context, this paper gives the status of tasks aiming at developing some of the measurement systems and necessary R&D for ITER strategy validation.
In a first part, this paper will provide outcomes of tasks on in-VV dust measurement diagnostics: 1) On Divertor Erosion Monitor aiming at measuring erosion and deposition on divertor vertical targets: A detailed optical path was defined and an outline design produced. 2) On Capacitive Diaphragm Monitor (gauges) allowing direct measurement of dust: a) Extensive characterization and calibration of gauges in laboratory conditions were done. b) An enhanced electronics and an housing were developed for in-VV tests. c) Gauges were tested in AUG to check their behaviour under harsh conditions (radiation, electromagnetic field). d) An outline design for integration in ITER was produced, together with recommendations for operation in ITER. 3) On feasibility of measuring the quantity of "hot dust"using steam injection: a) A dedicated set-up was assembled and commissioned. b) An experimental matrix based on key relevant parameters (dust mean size, steam pressure, temperature) has been defined and tests performed.
In a second part, the status of experiments on effectiveness of desorption of tritium from Be co-deposits baked at 350℃ will be detailed. The paper will focus on: 1) Manufacture and characterization of prototypic set of layers 2) The release rates of deuterium during baking of the layers.

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