Simulating plasma - wall interactions in fusion reactors with beam - surface experiments

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Deuterium and tritium trapping in tokamaks' first wall is one major concern in fusion devices such as ITER or DEMO because of tritium recycling issues as well as nuclear safety regulation related to tritium radioactivity. In addition, production of tritiated ammonia is expected since nitrogen injection into the edge of the fusion plasma is necessary to maintain power fluxes to the plasma-facing components made of tungsten within tolerable limits. In this talk, I will present the beam-surface experimental approach developed at the PIIM laboratory of Aix-Marseille University to simulate such plasma - wall interactions. First, I will show results on deuterium ion beam implantation and retention in tungsten complemented by a density functional theory based macroscopic rate equations analysis. A focus on the effect of the surface oxide will be made. Second, I will talk about the production of deuterated ammonia from nitrogen and deuterium implanted in tungsten. Finally, I will present supersonic molecular beam measurements of the sticking probability of ammonia on tungsten.