Radiation defect data for a Virtual Tokamak Reactor Model

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Operation of a fusion or an advanced fission power plant is invariably associated with the accumulation of defects, produced by neutron and particle irradiation, in the bulk of reactor components. The accumulation of defects gives rise to strongly fluctuating spatially varying strain and stress fields, which on the macroscopic scale lead to irreversible deformations of components. Recent developments in the simulation methodology show how to relate the microscopic fields of defects to macroscopic strain and stress, and how to include these effects in the Finite Element Method simulation framework. This is expected to enable making the next step in the simulation methodology and develop an approach where a tokamak reactor design is evaluated, as an integrated evolving system, over its entire lifetime [1].

This presentation provides a summary of recent developments in atomistic density functional theory and molecular dynamics, as well as elasticity-based simulations, which form a foundation for the Virtual Tokamak model, and relate it to the new capabilities offered by the availability of IAEA database of collision cascades.

1. S.L. Dudarev, M.J. Caturla, P.M. Derlet, C. Domain, M.R. Gilbert, F. Hofmann, P.-W. Ma, J. Marian, D.R. Mason, P. Olsson, H. Tanigawa, E. Tarleton, G. Pintsuk, and M. Rieth, *From ab initio models to a Virtual Tokamak Reactor: current status and gaps* (2019), in preparation

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