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Radiolysis study of EU Li4SiO4 reference breeder material from the HICU experiment

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To proceed the solid breeder concept for ITER and DEMO it is essential to investigate Ceramic Breeder (CB) materials' properties. To ensure an adequate tritium production of the breeder material several requirements like a high lithium density, good tritium release behaviour, and a high resistance against neutron irradiation as well as thermomechanical stresses have to be fulfilled. Lithium orthosilicate (Li4SiO4), applied as pebbles, has been selected as reference material in the European Helium Cooled Pebble Bed (HCPB).

Beside standard material characterization, the response of CB materials to neutron irradiation is an important issue. Therefore, CB pebbles of the EU reference material were exposed to neutron irradiation in the HICU experiment (high neutron fluence irradiation of pebble stacks for fusion), that was carried out in the High Flux Reactor (HFR) in Petten (Netherlands) between 2008-2010. Different grades of Li4SiO4 pebbles containing a surplus of 2.5 wt% SiO2 and different 6Li-contents up to 20 % were included in the irradiation under DEMO relevant conditions.

While the Post-Irradiation Examination (PIE) on tritium release behaviour and material properties were recently presented, new and additional results of a radiolysis study on the Li4SiO4 samples was performed in Latvia will be presented here. Radiation induced Defects (RD) and Products (RP) were investigated using basically Electron Spin Resonance (ESR) and Raman spectroscopy. Further analyses on the tritium release behaviour were performed using Thermally Programmed Desorption (TPD).

The presented results will reveal new insights of CB pebbles' behaviour with regard to neutron irradiation and will therefore significantly contribute to the knowledge of CB pebbles' properties in a fusion relevant environment.

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