

MODELING OF TRITIUM BUBBLES TRANSPORT IN LEAD-LITHIUM IRRADIATION EXPERIMENTS LIBRETTO 4/1, 4/2 AND LIBRETTO 5

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In the framework of the European R&D for the Helium Cooled Lead Lithium (HCLL) test blanket concept for ITER, NRG has designed three new Libretto (Liquid Breeder Experiment with Tritium Transport Option) irradiation experiments.

Two experiments, Libretto 4/1 and 4/2, have been irradiated in HFR for 650 Full Power Days. The objective was to monitor on line the in-pile tritium production and permeation through Eurofer in contact with lead lithium eutectic. The irradiation of Libretto 4/1 and 4/2 has been conducted at 350 C and 550 C, respectively. Libretto 5 experiment has been irradiated for 520 Full Power Days in the temperature range of 300- 500 C with the objective to study tritium behavior in the lead lithium eutectic. The operation of the Libretto experiments included in-pile variations of hydrogen concentration in the purge gas and temperature transients.

To analyze the tritium release measured during the in-pile temperature transients a model of tritium transport has been developed. The model incorporated two mechanisms: bulk diffusion and via rising tritium-helium bubbles. It was demonstrated that the bubbles transport mechanism is much faster and in better agreement with the tritium residence times measured in the Libretto experiments.

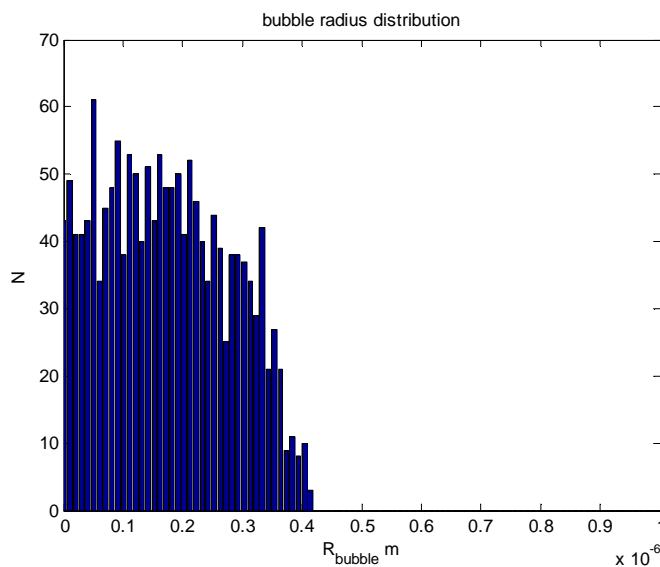


Figure 1: A typical size distribution of tritium bubbles obtained in the simulations of Libretto-5 experiment