# EXPERIMENTAL DETERMINATION OF REFERENCE SIEVERTS' CONSTANT AND DIFFUSIVITY VALUES FOR TRITIUM IN PB-LI

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The hydrogen transport properties of Sieverts' constant and diffusivity in the eutectic lithium-lead alloy have been experimentally evaluated by means of Absorption-Desorption Experiments carried out at the facility located in the University of the Basque Country (UPV-EHU). Three different campaigns have been performed using these absorption and desorption techniques. The tests have been done with temperature ranging from 523 K to 922 K and with loading pressures ranging from 1 Pa to $10^5$ Pa.

The rig comprises ultra high vacuum stainless steel components and volumes in Pyrex glass and quartz, so that any background H pressure release coming from the outgassing from the walls of the components is minimised. The ultra high vacuum ($10^{-7}$ Pa) is obtained by means of two pumping units comprising a turbomolecular and a two-stage rotary pump each. The W crucible containing the PbLi alloy is placed into the nozzle of the experimental chamber, where a resistance furnace provides the heat needed to operate over the entire range of the measurement temperatures. Two thermocouples register the specimen temperature, whereas a Pt-resistance thermometer registers the experimental chamber temperature. The evolution of the hydrogen pressure in the containing chamber is gauged by two capacitance manometers, covering the whole range of pressures obtained during the experiments. One Quadrupole Mass Spectrometer checks the purity of the supplied gas and the gas released from the specimen.

The research work in this area has a great importance for the liquid-metal breeding systems, such as Helium Cooled Lead Lithium or Dual Coolant Lead Lithium, as reference blanket options. Tritium transport parameters of solubility and diffusivity in the alloy can be extrapolated from these data in order to determine the magnitude and kinetics of the induced tritium flux from the breeding region to the helium cooling loop.

This paper presents the work performed in the preparation of the facility as well as the modelling, and describes the three different campaigns of measurements carried out to obtain this correlation. Low solution energies for hydrogen in lead lithium are confirmed in coherence with global solubility database in literature. The proposed correlation for hydrogen solubility in lead-lithium from these tests is $K_s$ [mol·m$^{-3}$/Pa$^{1/2}$] = 8.637 $10^{-3}$·exp(–0.9/R$T$), R in (kJ·K$^{-1}$·mol$^{-1}$).