LIMITATION OF TRITIUM OUTGASSING FROM FUSION REACTORS WASTE DRUMS: THEORETICAL ASPECTS OF HYDROGEN OXIDATION.

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The conversion or trapping of hydrogen has been already extensively studied under high temperature [1], low partial pressure of hydrogen [2] and under high partial pressure of hydrogen [3], [4]. These studies have demonstrated that three kinds of materials were able to either convert or trap hydrogen (as well as deuterium and tritium) with acceptable yields and without any maintenance:

- Organic compounds [2].
- Metal hydrides [4],
- Pure or mixed metal oxides [4].

Tritium degassing is one of the main criteria defined by the French Nuclear Waste Management (ANDRA) for waste classification and storage, the level of these criteria depends on the chemical form of degassing tritium, mainly HT and HTO. The aim of this study is to determine the respective influences of experimental parameters (gas flow and initial concentration, reactant mass) on the conversion rate of gaseous tritium - simulated here by very low initial hydrogen concentration.

Moreover, within the scope of our study, these compounds have to be thermally stable, chemically inert (obviously except towards hydrogen and its isotopes) and must present, in order to be as representative as possible of what occurs in a real waste drum, a good conversion rate at both ambient temperature and pressure. Due to their fusion temperature relatively low (between 80 and 180°C) [2], organic compounds are excluded, as well as metal hydrides because of their high reactivity with water [3]. Thus, the chemical mechanism involved here is the oxidation of hydrogen by metal oxides. Then, the water produced can be finally trapped.

Consequently, we present the preliminary results of a theoretical model developed at CEA Cadarache which simulates the behaviour of hydrogen oxidation by a specific metal oxide mixture at both ambient temperature and pressure. Based on experimental results obtained at a range of low initial hydrogen concentrations, this model allows one to perform calculations which simulate the behaviour of this specific metal oxide mixture under real tritium degassing conditions.

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