MOTIVATION

Detection of relic neutrinos requires the use of graphene one face covered with monoatomic tritium. In particular it is desirable to obtain a coverage close to 100% and also in the form of monoatomic tritium as betas emitted from the tritium molecule do not have enough resolution in energy to be used within the neutrino detector. Unfortunately, most of the tritium absorption on graphene occurs in the form of molecule and not in the required atomic form and consequently it is necessary the use of tritium loading technologies based on ionization processes as either plasma loading or energetic particle bombardment. In principle, tritium absorption induced by energetic electron beam would be a good technique as electrons, due to their low mass, do not produce radiation damage consequence of atomic displacement meanwhile they produce the required ionization processes. Finally bombardment with energetic electrons will simulate the possible self irradiation effect on graphene from betas produced by the loaded tritium.

It is expected that the irradiation with electrons will have an effect on absorption-desorption processes, oxidation-reduction, crystal damage or recrystallization.

WORK DESCRIPTION

The work will be divided in three different phases

PHASE1: Comparison of the deuterium absorption with and without irradiation for different graphene-like materials

Samples of solid graphite, graphite in the form of dust, graphite oxide, reduced graphite oxide, graphene oxide, one and two layers of graphene deposite don SiO2 will be mounted onto an special loading chamber and will be exposed to deuterium gas at a pressure of 1 bar, at 50 C during 6 hours.

An equal lot of samples will be also exposed to deuterium gas at 1 bar, 50 C but in this case the lot of samples will be exposed to 1.8 MeV electron irradiation generated with the CIEMAT Van de Graaff accelerator. The beam current density will be 10 microA/cm2.

Once the two loading process, with and without irradiation, are finished tha samples will be studied making use of different techniques:TSD, SIMS, Rama, FTIR, x-ray analysis, etc.

PHASE 2: Developement of a technology for the graphene deuterium loading in the monoatomic from

Based on the previously carried out fundamental experiments it will be developed a technique to load graphene with deuterium

PHASE 3: Implementation of the developed technology to be used at a tritium facility

Capability to handle tritium does not exist at Ciemat. It will be identified a suitable laboratory with the capability to handle tritium and then the technology developed at Ciemat with deuterium will be implemented for tritium.