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PLASMA FACING COMPONENTS FOR NUCLEAR FUSION REACTORS PRODUCED AND ANALYSED AT INFLPR

A clean and safe energy is in high demand nowadays. The levels of pollution due to the conventional energy resources led in to the highest increase of the global average temperature in its recorded history. The conventional resources for energy production are limited and the aim is to find a solution for alternative energy production.
Between many developed technologies to produce renewable energy as water plants, wind power generators, those based on wave energy and converting solar energy into electricity, nuclear fusion energy generation is one international worldwide target for the science and engineering community. The present generation of nuclear fusion reactors, represented by the International Thermonuclear Experimental Reactor (ITER) that is under construction at Cadarache in France, being the largest research project on this field. The study of ITER related mixed materials are well developed and the results are quite remarkable, science projects changing continuously the design of ITER as it is being built.
More than 100.000 shots were produced in an ITER similar fusion research machine developed since 1983 which is in operation as Joint European Torus (JET) reactor in UK, the world's largest and most advanced tokamak [1].
The presence of tritium in conjunction with the presence of beryllium in the reactor is considered a hazard in terms of the safety of the reactor operation from a radioactive point of view (tritium) and from a toxic point of view (beryllium). On the other hand, the most important objective is the development of procedures or materials that can reduce the degree of retention of tritium in the walls. It will be retained mainly in the co-deposited components and layers of beryllium [2].
Beryllium and tungsten-based components were developed at National Institute for Laser, Plasma and Radiation Physics (NILPRP) and installed in ITER-like (ILW) wall at JET machine and a wide range of experiments were performed. A lot of Inconel tiles coated with beryllium, marker tiles consisting in bulk beryllium, a nikel interlayer and a beryllium top layer were produced in Romania using thermionic vacuum arc plasma method and installed on ILW. Also, more than 5000 tiles made of carbon based materials from the first wall of the fusion equipments from JET (UK), AUG (Max-Plank Institute for Plasma Physics, Garching, Germany), WEST (CEA, France), DIII-D (General Atomic, USA) were coated with W coatings.
The fusion plasma influence on the first wall tiles, as well as the production using high-power impulse magnetron sputtering (HIPIMS) and characterization of Be reference coatings with varying composition, morphology and grain structure were investigated and presented in this talk.
This work has brought several important results which have provided insight into deposition phenomena in the large-scale beryllium and tungsten structures obtained in our institute. A comprehensive analyses have been carried out for materials retrieved from all important locations in the JET machine.

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