

A Study of Surface of Titanium Targets for Neutron Generators

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Abstract : The development of tritium and deuterium targets for neutron tubes and generators is a part of the activities in All-Russia Research Institute of Experimental Physics (RFNC-VNIIEF). These items contain a metal substrate (for example, copper) with a titanium film with a few microns thickness deposited on it. Then these metal films are saturated with tritium, deuterium or their mixtures. The significant problem in neutron tubes and neutron generators is the characterization of substrate surface before a deposition of titanium film on it, and analysis of the deposited titanium film's surface before hydrogenation and after a saturation of the film with hydrogen isotopes. The performance effectiveness of neutron tube and generator also depends on upon the quality parameters of the surface of the initial substrate, deposited metal film and hydrogenated target. The objective of our work is to study the target prototype samples, that have differ by various approaches to the preliminary chemical processing of a copper substrate, and to analyze the integrity of titanium film after its saturation with deuterium. The research results of copper substrate and the surface of deposited titanium film with the use of electron microscopy, X-ray spectral microanalysis and laser-spark methods of analyses are presented. The causes of surface defects appearance have been identified. The distribution of deuterium and some impurities (oxygen and nitrogen) along the surface and across the height of the hydrogenated film in the target has been established. This allows us to evaluate the composition homogeneity of the samples and consequently to estimate the quality of hydrogenated samples. As the result of this work the propositions on the advancement of production technology and characterization of target's surface have been presented.

Keywords : tritium and deuterium targets, titanium film, laser-spark methods, electron microscopy

Conference Title : ICHPS 2017 : International Conference on Hydrogen Production and Storage

Conference Location : Tokyo, Japan

Conference Dates : September 07-08, 2017