

## INFLUENCE OF ZR-1NB SURFACE STATES ON HYDROGEN SORPTION CHARACTERISTICS

M.N. Babihina

Scientific supervisor: Assistant, TPU, V.N. Kudiyarov

National Research Tomsk Polytechnic University,

Russia, Tomsk, Lenin Avenue, 30, 634050

E-mail: [m.babihina@mail.ru](mailto:m.babihina@mail.ru)

Zirconium and its alloys are important elements of the nuclear power reactors core. In addition, zirconium has a low neutron capture cross section and good corrosion resistance [1]. However, zirconium parts of reactors are exposed to hydrogenation during operation and hydrogen embrittlement can be destructed. Metal surface is important factor for hydrogen penetration process. For example, surface modification [2] or barrier coatings deposition [3] can prevent hydrogen penetration. However, hydrogen sorption rate should be increased in some cases and coatings of nickel or palladium can be used for it. Nickel has high physical adsorption and chemical activity relative to hydrogen, as well as high permeability for hydrogen [4]. Temperature and hydrogen pressure considerably influence the hydrogen sorption rate. Thus, there is the problem of determining the effect of pre-treatment of the material and the method of hydrogenation parameters on the features of interaction of hydrogen with the alloys. Determination of activation energy of hydrogen sorption before and after coating deposition or surface modification will not only compare different methods of modification, but also provide additional information, which can be used for modeling of hydrogen sorption processes. The objective of this study is to develop methodology for calculating the energy of activation of hydrogen sorption in zirconium alloys with different surface states.

### REFERENCE

1. Voevodin V. N. (2007). Issues of Atomic Science and Technology. –№. 2. pp. 10-22.
2. Boyko V. I., Valyaev A. N., Pogrebnyak A. D. (1999). Metal modification by high-power pulsed particle beams. Advances of Physical Sciences. V. 169. №. 11. pp.1243-1271.
3. Kozlov V. A., Mesnik M. O. (2011). Fundamentals of corrosion and protection of metals.
4. Bibienne T. et al. (2015). Synthesis, characterization and hydrogen sorption properties of a Body Centered Cubic 42Ti–21V–37Cr alloy doped with Zr 7 Ni 10. Journal of Alloys and Compounds. V. 620. pp. 101-108.
5. Glazunov G.P. and etc. (2009). Kinetics of hydrogen penetration in fuel element shells from Zr-1% Nb alloy. Issues of Atomic Science and Technology. №. 2. pp. 90-94.

### LIGHTNING ENERGY: PRO ET CONTRA

Buchatskiy D.V., Brykov D.A.

Scientific adviser: E.Yu. Kosheleva, Associate Professor

National Research Tomsk Polytechnic University,

Russia, Tomsk, Lenina Avenue., 30, 634050

E-mail: [tinnaa@list.ru](mailto:tinnaa@list.ru)

Lightning energy, basing on the capture and accumulation of lightning, is still in its infancy. The main problems of lightning energy are mobility of storm fronts and speed of atmospheric electrical discharges, impeding accumulation of energy.

#### Advantages of the atmospheric power are as follows:

- Land and ionospheric supercapacitor constantly recharges using renewable energy sources - solar and radioactive elements of the earth's crust;
- Atmospheric power plant doesn't release pollution into the environment;