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DETERMINATION OF THE NICKEL COATING ON THE Zr1%Nb ALLOY THICKNESS BY X-RAY METHOD

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Physical, chemical and mechanical properties of metals and alloys depend on the penetration and accumulation of hydrogen. This is acute for zirconium and titanium alloys, which are widely used in the nuclear industry [1]. For various research special preparation of samples is required with respect to hydrogen concentration and volume distribution of the material. With hydrogenation of alloys it is important to consider the possibility of oxide film formation on the sample surface which prevents penetration of hydrogen. Nickel coating on the surface increases the rate of hydrogen sorption. Furthermore, nickel is oxidized worse than titanium and zirconium, this property contributes to hydrogen absorption. Therefore, it is important to take into account the thickness of the nickel layer and its adhesive behavior.

During the work flat samples of Zr1%Nb alloy were prepared. Samples were subjected to mechanical polishing to remove surface dirt. Nickel layer was coated by magnetron sputtering method at different deposition time, which varied from 10 to 40 minutes.

The analysis of the thickness of the coating was carried out in three different ways: by the distribution profiles of nickel in depth, by spherical abrasion test method and by X-Ray diffraction method.

Calculation of thickness by XRD method was carried out on a Shimadzu XRD-7000S diffractometer in the grazing beam geometry. The penetration depth of the X-Ray beam varied by reducing the angle of incidence until the signal from the substrate is supressed [2].

Measurements of the adhesion strength were made by the Micro-Scratch Tester MST-S-AX-0000. The critical load was determined during the measurement by scratching with a diamond indenter. The critical load is the minimum load at which the coating starts to destroy.

Present study demonstrates the possibility of determining the thickness of the micronic coatings by X-Ray diffraction method. The correlation between the calculation results of the distribution of nickel in depth, by spherical abrasion test method and by X-Ray method is established. The appropriate thickness of the nickel layer with the best adhesive properties and acceptable rate of hydrogen sorption was determined.

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ENERGY EFFICIENCY DEVELOPMENT

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The scientists of United National Industrial Development Organizations (Africa) state that «Energy efficiency is understood to mean the utilization of energy in the most cost effective manner to carry out a manufacturing process or provide a service, whereby energy waste is minimized and the overall consumption of primary energy resources is reduced. In other words, energy efficient practices or systems will seek to use less energy while conducting any energy-dependent activity: at the same time, the corresponding (negative) environmental impacts of energy consumption are minimized».

The impacts of energy use affect all of us and consequently, we should all be concerned about how to use energy more efficiently. However, the main bodies responsible for defining national approaches to energy efficiency are typically government agencies, whose responsibilities will usually include:

1. Enacting legislation which relate to energy efficiency if required, including defining an oversight role for energy regulators, when relevant.
2. Deciding the state budget for promoting and conducting energy efficiency activities and programmes for the general public, including tax or other incentives when appropriate.
3. Promoting energy awareness and disseminating useful information on energy efficiency measures and on recommended procedures for all sectors of the economy.
4. Allocating the budget and carrying out energy efficiency programmes in relation to government-owned assets, e.g. government buildings, vehicle fleets. These actions will serve as examples of good practices for others to follow.

Renewable energy technologies tend to have a higher profile than energy efficiency actions. This is mainly for the obvious reason that they are more visible as new installations and perceived as more «cutting-edge» technologies. This occurs even though they often have higher initial capital costs than energy efficiency measures (and may have less favorable operating costs too). However, one of the benefits of adopting renewables is the ensuing increase in awareness of energy production and consumption in the owner of the installation and also often with the public who can see or might interact with the technology.

This increased awareness of energy consumption may be used to stimulate awareness of energy efficiency by introducing energy efficiency measures simultaneously with a new renewable energy installation.