Nanocomposites and nanomaterials

Structural, catalytic and thermal properties of stainless steel with nanoscale surface layer

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The implants containing of Al, Ni, Cr, Ti, Mo and Zr based on stainless steel foil (SSF) were prepared by low temperature implantation method with one or two elements (step by step) deposition. The synthesized composites were studied by means of traditional XRD and XRD of thin films, SEM, AFM and XPS methods. The temperature of the surface composites at their heating by electric current was established. The catalytic properties of the samples in hydrogen production from ethanol was determined in traditional catalytic reactor (with reaction mixture heating) and in reactor with catalyst heating by electric current only.

The results of XRD study of the prepared composites show the presence of austenite phase, characteristic for the stainless steel support (SSF) only.

SEM methods it was shown that the metals implantation forms surface layer with thickness about 100 nm. Besides SEM and AFM methods have demonstrated that the ionic bombardment essentially change the support surface morphology.

It was shown that at the heating of the samples by electric current the temperature on surface of the implanted samples has higher values than in case of industrial electric heating element or initial support (SSF) used.

Thus, machining of stainless steel by the ionic implantation allows to obtain materials with high thermal and mechanical characteristics. The synthesized materials acquire catalytic properties and structural characteristics lead to the conclusion that they are promising as carriers. All in all, the foregoing indicates a significant qualitative change in the steel samples and their transition into the category of materials-implants with a set of characteristics that have practical use.