EFFECT OF HEAT TREATMENT ON MICRO HARDNESS OF ELECTROLESS Ni-P LAYER UNDER IRRADIATION AND NON IRRADIATION CONDITION

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The Ni-P alloys with phosphorus content of 7-15% in form of coating deposited on the surfaces of different materials are used as anticorrosion protection as well as to increase hardness of these surfaces. Heat treatment of Ni-P alloys can cause significant changes in properties and structure. It is well known that heating of as deposited Ni-P layer to temperatures of 300-400 °C for 1 hour causes a transformation from the amorphous to the crystalline phase. Crystallization of the amorphous alloys Ni-P leads to various Meta stable phases, which are subsequently transformed to stable phases. After this phase transformation, face-centered cubic (f.c.c) Ni austenite and body- centered tetragonal (b.c.t) Ni_3P are present. The hardness of Ni-P deposits can be increased due to the precipitation hardening of crystalline Ni_3P and Ni phases. This indicates a possible high reactivity with respect to oxygen [1-3].

In this research the changes of phases and microhardness behavior of Ni-P coated stainless steel 304 were made using a Vickers micro hardness tester under a load of 10- 200 gr with loading time 10 s after gamma irradiation in room temperature(R), heat treated in 400°C under gamma radiation(R/T) and heat treated without gamma irradiation (T) in 400 °C, in H_2O environment for 5 hours.

Fig(1) and 2 shows the effect of radiation(R), radiation with thermal (RT) and heat treatment with out irradiation(T) in H_2O environment for 5 hours on the microhardness and phase transformation of the Ni-P alloys deposits respectivly. Hardness of all samples increase slightly with an increase in load indention untill 50 g , after this load the hardness of samples decrease with increas of load indention. It is evident that the increase of hardness with the increase of load, indicated that phases of top surface are softer than the sublayer phases. With evalution of line scan , EDX and XRD analyses(fig 2) it is evident that top surfaces phases are phousphor oxides and sublayer phases are Nikel phosphid(Ni_3P) which these phosphid phases(Ni_3P) are hardness than oxide phases. With deeper indention, the substrate effect (294 HV) is induced by larger loads, and the contribution of the Ni-P coating decreases.

According to achieved results it can be concluded that the electroless Ni-P coatings were hardened by the formation of the Ni_3P phase and the crystallization of Ni after heat treatment during the radiation- thermal and thermal process.

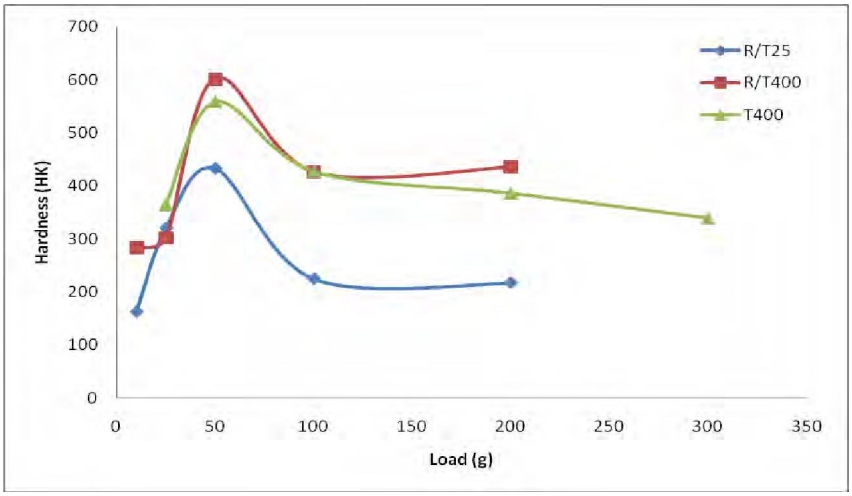
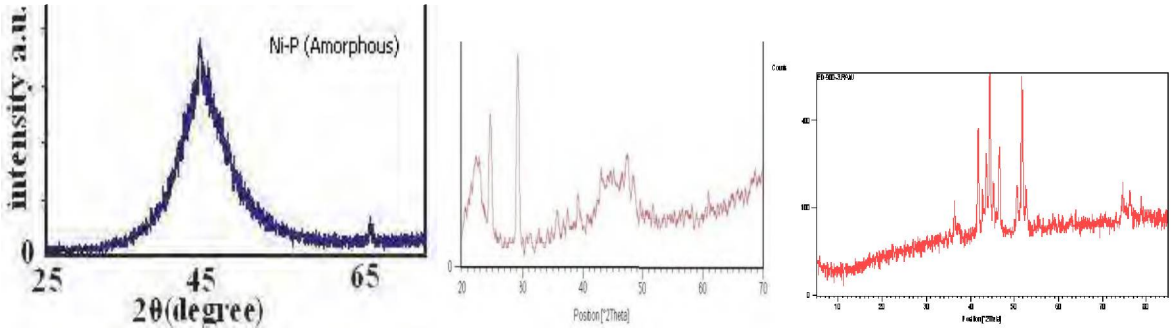


***Fig 1**: The hardness of heat treated Ni-P coatings in irradiation and non irradiation condition under various loads.*



a b c

***Fig 2**: XRD of Ni-P layer: a) before, b) after gamma radiation and c) after heat treatment in high temperature water (400°C) in irradiation and non irradiation condition.*

Refrences

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