Sonochemical surface modification of galvanic nickel in the presence of vanadium acid

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The sonication of nickel films in the aqueous solution of vanadium acid results in the immobilization of vanadium oxo-compounds at the nickel surface in the form of hydrated V_2O_5 as evidenced by EDX and IR spectroscopy. The sonochemically derived epitaxial films of V_2O_5 are chemically bound to the nickel surface, with the amount of the sonodeposited V_2O_5 saturating at the level of 0.35 mmol cm^{-2}. The sonochemical deposition involves the following stages: (i) binding of vanadates with nickel and (ii) sonoinduced polycondensation of anchored oxo(hydroxo)-species that ensure filling of nickel surface with vanadium oxide as demonstrated in the insertion in Fig.

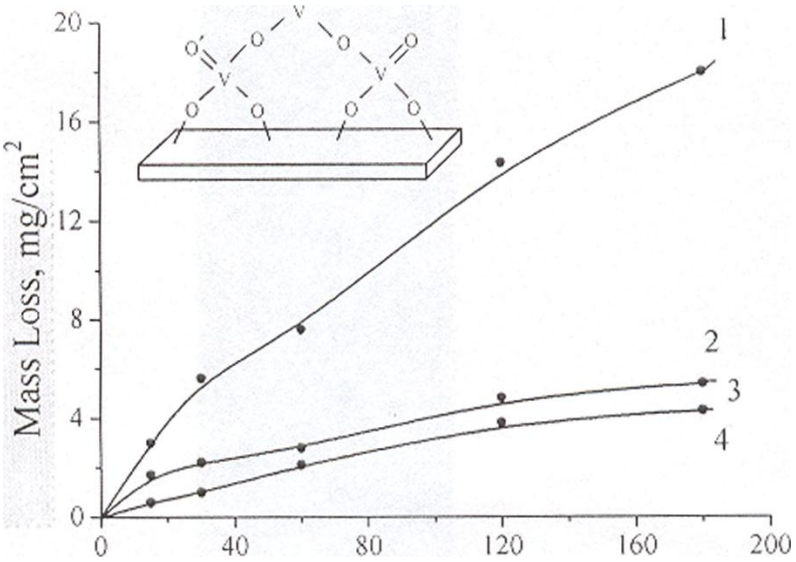

Fig. Mass loss during mechanical wearing for (1) bare nickel, (2) V_2O_5-modified nickel, (3) benzolriazole: V_2O_5-modified nickel. The scheme of sonochemical modification of nickel surface by vanadium oxide is given in the insert

The sonochemical modification of nickel improves the corrosion stability of nickel film (by 50%). The corrosion susceptibility exhibits 3-fold decrease after sonochemical modification in the presence of benzotriazole. IR spectroscopy points to the incorporation of benzotriazole (known to behave as a corrosion inhibitor) into the sonohemically derived film of hydrated V_2O_5 which thus plays a role of the depot for inhibiting agent.

The ultrasound-assisted deposition of surface films of V_2O_5 leads to radical (3-fold) enhancement of wear resistance of nickel coatings (most probably due to antifriction properties imparted to nickel surface by deposition of V_2O_5 of lamellar structure [1]). Further enhancement of wear resistance is observed in case of V_2O_5 films grown in the presence of benzotriazole which ensures 5-fold increase of wear resistance as compared to bare nickel. High mechanic stability of nickel coatings modified with benzotriazole-doped V_2O_5 films can be attributed to the suppression of the tribocorrosion processes.

References

1. T.V. Sviridova, L.l. Stepanova, D.V. Sviridov *J. Solid-State Electrochem*. (2012) 3799.