Nanostructured surfaces

Annealing influence on morphology and structure of metal nanofilms have been deposited onto nonmetallic materials

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Dispergation-coagulation processes of various metals (Ag, Au, Cu, Nb, Hf, Cr, Ni, etc.) nanofilms have been deposited onto oxide and nonoxide substrates and have been annealed under temperatures from 600 up to 1600 °C in vacuum. Nanofilms thickness averaged 100. Nonmetallic substrates have been made of the materials widely have been used in technics, in particular, from a quartz glass, ceramics on basis alumina oxide and zirconium oxide, sapphire, silicon nitride, graphite and carbon glass. The coating metals have been investigated can be divided into two groups: metals with high adhesion to substrate (Cr, Nb, Hf) and metals with low or limited adhesion (Ag, Au, Ni, etc.).

Metal nanofilms annealing have been made in vacuum not worse $2x10^{-3}$ Pa but silver and gold films onto oxide substrates have been annealed on air also. As result of annealing of films onto all nonmetallic substrates metal films dispergation down to their full disintegration under high temperatures and long times presence of them under these temperatures have been occurred. In some cases at long annealing fragments films coagulation have been observed. As result of this coagulation the small fragments (drops) have been gathered in larger drops. Most plain these processes were showed at annealing on air silver nanofilms have been deposited onto oxide materials (sapphire, quartz glass and alumina ceramics). The minimum temperature at which silver films disintegration have been started is 400 °C but at 600 °C active drops coagulation have been occurred already after 15 s presence under these temperature and during the first minute of annealing this process practically finished.

Copper and gold nanofilms intensively have been dispergate at annealing in vacuum only in temperatures interval 900 – 1000 °C onto all nonmetals have been investigated.

Niobium and hafnium nanofilms onto oxides under annealing in vacuum start dispergate only at high temperatures (1500 °C and is higher).

The received results on dispergation and coagulation of metal nanofilms onto nonmetallic substrates are significant for development of brazing technological processes of nonmetallic materials with metals.