Nanostructured surfaces

Annealing influence on dispersion kinetics of titanium and zirconium nanofilms deposited onto oxide materials

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Joining ceramics and other non-metallic materials (sapphire, monocrystals, etc.) with metals by brazing using metallic brazes or pressure welding joining using deformable metal gasket found wide applying in modern technique. For manufacturing of qualitative materials joining by brazing or pressure welding metallic materials are often has been coated by different metals films.

Perspective is the use of adhesive-active metals titanium and zirconium in the form of thin films, particularly nanofilms, which gives the opportunity to develop fabrication technology of precision and strong dissimilar materials joints with very fine brazing seam.

In this work the dispersion kinetics of titanium and zirconium nanofilms deposited onto of alumina oxide (leycosapphire) and ZrO_2 monocrystals during annealing in vacuum in temperature range 1300 ÷ 1600 °C was investigated by metallography, scanning electronic microscopy and atomic-power one methods. It was found that these films have almost no changes its structure during annealing up to 1400 °C, and under further rise annealing temperature and time of annealing disintegration process of films was intensified significantly. This films disintegration on both given oxides has approximately the same character and practically finished by completely dispersion of titanium film on separate fragments as a result of annealing up to 1500 °C during 10 min and significant dispersion of more refractory zirconium nanofilms after 20 min annealing ay 1600 °C. The intensity of titanium films dispersion onto investigated oxides is slightly higher comparatively to zirconium ones. This phenomenon can be explained by different affinity for oxygen of these metals.

The results can be used for developing of manufacturing technology for non-metallic materials high temperature joining by brazing or diffusion bonding using titanium and zirconium nanofilms as metallization coatings.