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The effects of cathodic arc parameter on color and hardness of ZrN thin films decorative coating

This research presents the effects of deposition parameter on zirconium nitride (ZrN) thin film coated on stainless steel by cathodic arc technique. For the jewelry applications, the ZrN films must have the high hardness with high gold color. The deposition parameter in this work consists of input voltage supplied to substrate, percent of duty cycle, flow rate of nitrogen gas and deposition time.The as grown ZrN thin films characterized using several techniques. The structural properties was analyzed by x-ray diffraction method. The color of films were analyzed by CIE-L*ab measurement. The morphology and hardness were characterized using scanning electron microscope (SEM) and nano-indentation respectively. The results revealed that all ZrN thin film showed color shade in yellow gold obtained from deposition conditions of the flow rate of nitrogen 50-250 sccm, the input voltage 250-550 V, deposition time of 5-25 minutes and percent of duty cycle in rang of 30%-70%. However, in this work we found two optimum condition. The first condition is the flow rate of nitrogen of 250 sccm, input voltage 450 V, 50% of duty cycle with deposition time of 15 minutes. The ZrN films presented by using the 1st condition showed that the hardness of films were 15 GPa, brightness 77.2%, The red rate –2.3%, the yellow rate 24.96% in CIE-Lab.* The second condition is the flow rate of nitrogen 250 sccm, input voltage 350 V, 50% of duty cycle and deposition time 25 minutes. The ZrN films grown by 2nd condition shows the hardness of 15.04 GPa, the brigthtness of 68.2%, the red rate –2.3%, the yellow 24.96% in CIE-L*ab* condition.

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