OR0404

Spotless arc activated high-rate deposition using novel dual crucible technology for titanium dioxide coatings

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Spotless arc Activated Deposition (SAD) combines electron beam high-rate evaporation using axial gun and a spotless arc discharge burning in metal vapor on hot evaporating cathode. SAD process is suitable for evaporation of high-melting metals like titanium, zirconium or tantalum providing high deposition rate up to 2000 nm/s. Moreover plasma-activation of deposition enables reactive mode of operation and deposition of oxides, nitrides or other compounds with a deposition rate in the range of 20 to 100 nm/s. Limitation of long-term stability of SAD process caused by coatings deposited at anode equipment could be overcome by introduction of a novel dual crucible technology. While evaporating metal within the first crucible acts as cathode, evaporating material of the second crucible forms the anode of the arc discharge. Both plasma electrodes being in contact to vapor and reactive gas are evaporating and plasma process can’t be disturbed by coating of electrodes anymore. The process has been engineered for high-rate electron beam evaporation and is well matched to large area coating. Main properties of SAD process with dual crucible were studied in case of evaporation of pure titanium and reactive processing in oxygen atmosphere in order to deposit titanium dioxide coatings on steel strip.Both crucibles were heated by fast deflected electron beam generated by a single axial electron gun in a power range of 10 to 50 kW. Main process parameters and discharge characteristics will be presented. In order to check long-term stability of the process titanium dioxide coatings were deposited on continuously moved 250 mm wide stainless steel strip. Dynamic deposition rate of oxide layers was between 500 and 1000 nm m/min. Optical properties concerning absorption and refractive index of the TiO_2 coatings were investigated by ellipsometry. Finally, an outlook about potential applications of this technology is presented.

Keywords
PVD
arc discharge
electron beam
titanium dioxide
plasma-activated