ABSTRACT

The remarkable properties of chromium carbide (Cr_3C_2) include the high hardness, high thermal stability and wear resistance that have many applications ranging from protective coatings on industrial tools to aerospace manufacturing. Various deposition methods have been employed to synthesize the chromium carbide films. However, the deposition of chromium carbide thin films by Dense Plasma Focus (DPF) have not been done earlier. So, the main purpose of present work is to investigate the structural and mechanical properties of chromium carbide thin films deposited on the substrate of Al-Cu alloy by engaging the setup of DPF. Films were deposited by varying argon gas concentrations (0 to 40 %) in argon- acetylene admixture by keeping constant number of focus shots (20). X-ray Diffraction (XRD) spectra for all exposure conditions except 100 % acetylene (C_2H_2) concentration showed the growth of polycrystalline Cr_3C_2 thin films. The crystallinity of Cr_3C_2 thin films was found to increase with increasing argon concentration up to 20 % and it was decreased with further increase of argon concentration in argon- acetylene admixture. Scanning Electron Microscopy (SEM) results showed round shape nanoparticles for 100 % C_2H_2 concentration. With the introduction of 10 % argon concentration, surface morphology changed into rough surface and then it transformed from rough surface to granular morphology for 20 % and above argon concentration in argon- acetylene admixture. Electron dispersive X-ray (EDX) analysis confirmed the presence of chromium and carbon contents in deposited films. Micro-Vickers hardness tester results showed that maximum surface hardness value is achieved 410 HV for 20 % argon concentration in argon- acetylene admixture.