



## ABSTRACT

In this research work, different parameters of composite thin film of Al-C-N developed by using extracting ion beams from 2.3kJ plasma focus device were studied. The relativistic electrons were responsible to ablate the carbon ions from the graphite target and then it deposited into the surface of Al substrate in the environment of nitrogen gas. Different characterization techniques were used to characterize the samples such as X-Ray diffractometry (XRD), Scanning electron microscopy (SEM) and Raman spectroscopy, which were treated with 5, 10, 20, and 30 plasma focus shots. These techniques were used to examine the crystallite size, crystal structure, surface morphology, film thickness and vibrational modes of Al-C-N. The crystallinity and crystallite size of carbo-nitride phase increased from 27.37 nm to 68.35 nm by increasing the plasma focus shots upto 30. The residual stress due to diffusion of nitrogen and carbon ions into the aluminum lattice was maximum for lower number of focus shots. When the number of focus shots increased due to high energy flux density the thickness of deposited film also increased. The texture co-efficient analysis showed that the AlN(111) planes were arranged more abundantly as compared to AlN(200) plane for 30 plasma focus shots. The SEM analysis was used to determine the surface morphology of treated Aluminum substrate. By increasing the plasma focus shots the smoothness of film was increased. The increasing trend of size and distribution of crystallites were observed for sample treated with 30 number of plasma focus shots. The Raman spectroscopy was done to discuss the Raman active modes of  $Al_4C_3$ , AlN and composite of Al-C-N. The experimentally measured Raman modes were approximately same as compared to the modes which were predicted by Group theory. The +ve frequency shift was observed in G peak position by varying the plasma focus shots up to 30. The increasing trend in  $I_d/I_g$  ratio was observed for higher number of plasma focus shots. Hence,  $sp^2$  content was increased and graphitic nature of composite film was observed.