# Transformation of PEO coatings from crater to cluster-based structure with increase in DC voltage and the role of $ZrO_2$nanoparticles

Zeeshan Ur Rehman*, Seong Hun Shin and Bon Heun Koo

School of Materials Science & Engineering, Changwon National University, Changwon 641-773, Korea
(E-mail:bhkoo@changwon.ac.kr)

**초 록** : Two step PEO ceramic coatings were formed on AZ91 magnesium alloy in $ZrO_2$ nanoparticles and $K_2ZrF_6$ based colloidal electrolyte solution for various voltages. Surface and layers tructure of the coatings was analyzed using SEM (ScanningElectronMicroscope). Structure analysis revealed that surface of the coating was transferred from individual pancake or craters-based structure to cluster-based structure with increasing the voltage of the secondary step process. Further, it was confirmed that the cluster zone was richin Zr-based complexes and formed due to high intensives parks. Increase in the Zr contents as discovered from the EDS analysis confirmed the rise in amorphous form of the Zr-based species, which justified the results of XRD where no increase in the intensity of Zr-based species was observed with increase in voltage. Potentiodynamic polarizariotion and impedance spectroscopy techniques were used to evaluate the corrosion performance of the coatings. The highest corrosion resistance was found for coatings prepared at 240V. The same specimen was found having highest and uniform vickers hardness ~1070.5 HV. The superior mechanical and electrochemical properties of the said coating can be attributed to the defect-less microstructure and the optimal role of $ZrO_2$ nanoparticles in the secondary PEO process at 240V.