

Won-kyun YEOM<sup>1</sup> and Geun-young YEOM<sup>1</sup>

<sup>1</sup>Sungkyunkwan Univ., Korea, Republic of

Although the conventional PE-ALD has a lot of benefits in the deposition, the plasma source such as energetic radicals and ions may negatively influence on the substrate due to the bombardment onto the films. For overcoming this weakness, we use Very High Frequency (VHF) – 60 MHz; plasma-enhanced-atomic layer deposition (PE-ALD) with cobaltocene ( $\text{Co}(\text{Cp})_2$ ) precursors and  $\text{NH}_3$  reactants gas. VHF plasma has higher plasma density and lower electron temperature than conventional PE-ALD, it less affects onto the substrate surface. For showing this, the growth characteristics of plasma and the properties of deposited films are investigated. Above all, we compare the thin films' quality of PE-ALD (13.56 MHz) with PE-ALD (60 MHz). While low resistivity Co thin films are deposited by both frequencies, even much better high-quality thin films are observed for PE-ALD (60 MHz). We observe the Co film with SEM (Scanning Electron Microscopy), analyze the plasma properties with a Langmuir probe, and measure the surface morphology with AFM (Atomic Force Microscopy). The purity contents in PE-ALD Co film is shown by using X-ray photoelectron spectroscopy analysis. In this study, VHF PE-ALD is superior physical and electrical characteristics to conventional PE-ALD, it will be a good process to decrease the plasma side effect.