



PLASMA ASSISTED ATOMIC LAYER DEPOSITION AND DIAGNOSTIC

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In this talk, I will present the diagnostic of plasmas in the plasma assisted/enhanced atomic layer deposition (PA/PE-ALD) process. In the past years we have employed microwave electron cyclotron resonance plasma, radio frequency plasma, and high frequency plasma to assist ALD for metals, oxide, nitride fabrications. They are working in vacuum or atmospheric pressure. Certainly the compounds in these plasmas are totally different, and the role of the compounds, such as electron, ions, radicals and neutrals, is also different. With mass spectroscopy, optical emission spectroscopy, Langmuir probe and quartz crystal microbalance, the plasmas are diagnosed, and the reaction process in the film growths are assumed. Based on the mechanism we then construct the recipes for metals, oxides, or nitride in PA/PE ALD, which is dependent on the power source and the plasma parameters. For example, during the metal Cu deposition by PA-ALD, we use high frequency power source. The metal Cu with $\sim 1.72 \mu\Omega$ resistivity can be achieved at 500°C deposition temperature. It will greatly benefit to manufacture the flexible conductive plastic web. The PA/PE ALD the versatile technique for the ultrathin film growth are also used in organic solar cells, liquid diode, protection layer, barrier layer and so on. Now we are carrying out the plasma assisted atmospheric pressure ALD in roll-to-roll process, which shall be possible to use for industrial scale application in future.

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* Work supported by National Natural Science Foundation of China (Grant Nos. 11175024, 11375031, 11505013), Beijing Municipal National Science Foundation (Grant Nos. 4162024), the collaborative innovation center of green printing & publishing technology (No. 20160113).