ADVANCES IN LARGE PECVD PROCESSING TECHNOLOGY UP TO GEN 11 FOR TFT LCD AND OLED

Yi Cui, Applied Materials, Inc.
yi_cui@amat.com
Beom Soo Park, Applied Materials, Inc.
Gaku Furuta, Applied Materials, Inc.
Jinhyun Cho, Applied Materials, Inc.
Soo Young Choi, Applied Materials, Inc.
Robin Tiner, Applied Materials, Inc.
Allen Lau, Applied Materials, Inc.
Suhail Anwar, Applied Materials, Inc.

Key Words: PECVD, Metal-oxide TFT, a-Si TFT, Gen 11, Gen 8.5.

Recent surging demands for larger (>50") TVs rapidly driving display processing technologies toward bigger substrate sizes up to 10m^2 range. Meanwhile, high performance displays (OLED TV, iPad, iMac and 4K monitors…) have stretched a-Si mobility (<1), and metal-oxide semiconductors such as Indium Gallium Zinc Oxide (IGZO) have emerged as the preferred TFT solution for advanced displays 7" to 70"+, with advantage of high TFT mobility 10~65 m/(V·s), extremely low I_{off}, low V_{th}, few masks and high manufacturing yield.
Applied Materials has recently made key technical advances in AKT Plasma-Enhanced Chemical Vapor Deposition (PECVD) equipment enabling super large substrate PECVD processing, Key AKT PECVD progresses solving large area challenges includes higher plasma power handling (up to 40kW), plasma confinement and arcing prevention, plasma distribution engineering, gas flow distribution engineering, large and thin glass handling, and ultimately deposition thickness uniformity control over substrate ~10m^2.
In addition, AKT has recently developed large area MOx PECVD solution packages for Gen 8.5 (2500mm x 2200mm) and beyond, enabling reliable manufacturing of IGZO metal-oxide TFTs in major Fabs worldwide driving most advanced LCD and OLED TVs, monitors and tablets. AKT's MOx PECVD technology produces reliable large area manufacturing of high quality low Hydrogen SiOx dielectrics serving as critical gate insulator, etch-stop, buffer layer, interlayer dielectrics, or passivation layers, in particular those directly interfacing IGZO semiconducting layer very sensitive to Hydrogen, moisture and temperature. Gas flow distribution and plasma distribution has been particularly optimized for excellent uniformity across large glass substrates for film thickness and property for both SiOx and SiNx films using the same chamber.
Applied Materials AKT PECVD equipment has recently established global leadership in large area PECVD processing technology in producing core TFT layers powering >85% LCD TVs in the world, supported recent starting of over a dozen largest TV factories worldwide Gen 8.5 and above, in particular enabled >95% of advanced IGZO metal-oxide TFT display products including all latest OLED TVs, Apple iPads, iMac 5K or 4K displays, Microsoft Surface Pro 4, as well as major brand 4K or 8K monitors.

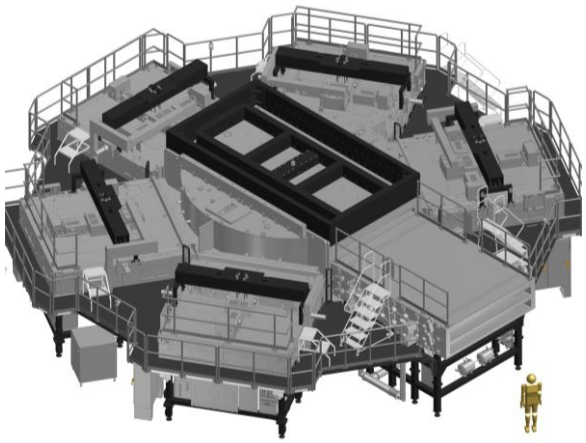

Figure 1 – Illustration of AKT Gen11 PECVD system, capable of processing glass substrate size of ~10m^2 for a-Si TFT LCD, or for IGZO metal-oxide TFT (with MOx upgrade package) LCD or OLED TV. System size: 15.0 m (L) x 14.5 m (W) x 4.3 m (H), Weight: 280 tons