

Title: Plasma-Based Thin Film Technology in Fabrication of Nano and Giga-Sized Electronics

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Abstract:

MOSFET-based ICs and TFT-based flat panel displays are the two largest microelectronic industries in the world. The general trend for the former is to shrink the device dimension to the nanoscale; the trend for the latter is to increase the product size to several meters. Thin films are critical for the device's performance and reliability. In addition to the tight-control of the geometry, profile, and yield, successful manufacturing processes have to satisfy three fundamental requirements: large area, high throughput, and low temperature.

Plasma processes, i.e., plasma-enhanced chemical vapor deposition (PECVD), plasma etching (PE)/reactive ion etching (RIE), and sputter deposition, have been proven effective in fulfilling the above requirements. Although demands on nano and giga-sized microelectronics are quite different, they can be achieved by delineating the complicated process-material-device relationship based on fundamental plasma physics and chemistry. In this talk, examples of manipulating the bulk film and interface properties to obtain the optimized device characteristics using the PECVD process will be given. Also, principles in achieving high etch selectivity, sloping the edge profiles, and minimizing the radiation damage to transistors in plasma etching processes will be discussed. In addition, the high crystallization temperature, amorphous sub-nanometer EOT high- k for gate dielectrics, nanocrystal-embedded nonvolatile memories, and novel solid-state incandescent light emitting devices prepared by the sputter deposition method will be reviewed. Think-out-of-the-box approaches, such as the new plasma-based, room-temperature copper etch process, can solve many challenging problems in the current industry as well as for future semiconductor manufacturing.

Short CV of Speaker

郭育 (yuekuo@tamu.edu) 是國立陽明交通大學光電學系終身講座教授、教育部玉山學者。他也是 Texas A&M University Emeritus Nesbitt Professor。他於 1974 年獲得台大化學工程學士學位，並於1979 年獲得獲得哥倫比亞大學博士學位。

郭教授在 1998 年開始學術生涯之前，曾在紐約 IBM T. J. Watson 研究中心和加州矽谷的Data General Corp. 半導體部門工作近20 年。他的研究重點是基礎理論、實驗用於先進IC、TFT平板顯示器、和光電半導體器件、材料、和製造工程。

由於郭教授在半導體研究的突破成果，他獲頒多項大獎，例如 Edward G. Acheson Award, Gordon E. Moore Medal, ECS Electronics and Photonics Division Award, etc. 他是 IEEE、ECS（電化學學會）、AVS（美國真空學會）和 MRS（材料研究學會）的 Fellow。他的兩本TFT書為業界經典著作。他是首位華人獲選為有121年歷史的 ECS 會長。他是全球連續舉辦時間最長(34年)的TFT會議和ULSIC vs. TFT會議(16年)的創始人。

