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Ultimate Top-down Etching Processes Using Advanced Neutral Beam for Future Nano-scale Devices

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For the past 30 years, plasma etching technology has led efforts to shrink the pattern size of ultra-large-scale integrated (ULSI) devices. However, inherent problems in the plasma processes, such as charge build-up and UV photon radiation, limit the etching performance for nanoscale devices. To overcome these problems and fabricate sub-10-nm devices in practice, neutral beam etching has been proposed. In this invited talk, I introduce the ultimate etching processes in the neutral beam sources and discuss the fusion of top-down and bottom-up processing for future nanoscale devices. Neutral beams can perform atomically damage-free etching and surface modification of inorganic and organic materials. This technique is a promising candidate for a practical fabrication technology for future nano-devices.