Plasmonic Structures and Applications Fabricated Using Collapsible Nano-Fingers and Implementation of “Cerebellum” for Mobile Robot using Memristor

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ABSTRACT

We have enjoyed the great successes of “Moore’s law” for more than half century. They have mainly been fueled by the semiconductor industry. Although the end of the roadmap may be getting closer, it is just the start of a new era when we will leverage the billions of dollars that have been invested in nanotechnologies (especially fabrication technologies) and the knowledge to make an even greater and broader impact on society. In my talk I will present two examples of the new frontiers: one in plasmonics, and one in nanoelectronics. In plasmonics, I will present a new technology to fabricate plasmonics structures with atomic precision, over large area, and with high reliability and repeatability. This technology is based on collapsible nanofingers. Based on this technology, we studied quantum tunneling in gap plasmon, and demonstrated label-free single molecule sensing with SERS. We also demonstrated plasmon-enhanced molecular fluoresce and plasmon-enhanced photocatalysis. In nanoelectronics, I will present our recent discovery on engineering the characteristics of memristors using the crystallinity of the switching materials. Moreover, we also implemented the function of “cerebellum” for a mobile robot using memristor based circuits. Those include analogue Kalman filter for sensor fusion and PD control circuit for balance control.

BIOGRAPHY

Dr. Wei Wu is an associate Professor at the Ming Hsieh Department of Electrical Engineering, University of Southern California. He graduated from Peking University with a BS in Physics in 1996, and received a Ph.D. in Electrical Engineering from Princeton University in 2003. He joined USC in 2012. Before joining USC, he had worked as research associate, scientist and senior scientist at HP labs. He is an expert on nanofabrication and applications. His work includes nanoimprint lithography and applications in nano-electronics, nano-photonics, plasmonics, chemical sensing and nano-electrochemical cells. He coauthored 106 peer reviewed journal papers, 2 book chapters and more than 100 conference presentations, including 16 keynote and invited presentations. He has 115 issued U.S. patents. The nanoimprint machine that he invented has been successfully commercialized by EZImprinting Inc. He is the chair of Nanofabrication track, IEEE Nanotechnology Council. He is a co-editor of Applied Physics A and an associate editor of IEEE Transactions on Nanotechnology. He was also an IEEE Nanotechnology Council 2015 and 2016 distinguished lecturer.

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