2nd Edition of
GRAPHENE & SEMICONDUCTORS | DIAMOND GRAPHITE & CARBON MATERIALS CONFERENCE
&
6th Edition of
SMART MATERIALS & STRUCTURES CONFERENCE April 16-17, 2018 Las Vegas, Nevada, USA

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Stiction assisted fabrication of single crystal silicon nanomembranes for MEMS applications

Silicon nanomembranes are suspended sheets of single-crystal silicon, less than a few hundred nanometers thick, with areas exceeding thousands of square micrometers. Challenges in fabrication arise from strains in the silicon-on-insulator (SOI) starting material, which result in buckling instabilities in thin membranes. I recently developed a simple technique to fabricate flat nanomembranes, with thicknesses as low as 5nm, using an elastically metastable configuration that is subsequently stabilized. The technique involves embracing, rather than avoiding, the effects of stiction, which are typically considered a detriment to MEMS fabrication. This ability to easily produce flat nanomembranes beyond the buckling threshold expands opportunities to study nanoscale properties free from the influence of a nearby substrate, but also provides a technology platform for smaller and more sensitive MEMS devices, from high-sensitivity, low-footprint pressure sensors to lab-on-a-chip devices for macromolecular separation and sensing.

Biography

Gokul Gopalakrishnan has a Ph.D. in Physics from the Ohio State University studying transport in two-dimensional electron gases. As a postdoctoral fellow at Harvard University, he investigated the metal-insulator transition in thin film and nanostructured vanadium dioxide. At the University of Wisconsin - Madison,Gopalakrishnan developed x-ray scattering tools to probe phonons in nanostructures. Currently at the Engineering Physics Department at the University of Wisconsin - Platteville, he is creating techniques to fabricate crystalline semiconductor nanostructures. Gopalakrishnan is on the board of the Regional Materials and Manufacturing Network, an academic-industry consortium to streamline materials research and development..

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