

Abstract Submitted
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Multiple-layer SOI based on Single-Crystal Si Nanomembrane Transfer¹ WEINA PENG, MICHELLE ROBERTS, ERIC NORDBERG, FRANK FLACK, PAULA COLAVITA, ROBERT HAMERS, DONALD SAVAGE, MAX LAGALLY, MARK ERIKSSON, University of Wisconsin Madison — Silicon-on-insulator (SOI) has many advantages over bulk Si including the reduction of parasitic resistance and increased device speed. Multiple-layer SOI, having more device layers per unit area, enables 3D process integration as well as applications in optics. However, it is impossible to achieve such a system by growth techniques (one can grow only non-crystalline Si on SiO₂), and multiple Smart Cut transfers used to create single layer SOI may be prohibitively expensive. We present here a novel method to fabricate such a multiple SOI system using transferred Si nanomembranes and subsequent oxidation. The surface roughness and interface quality are examined respectively by AFM and cross-sectional SEM. Low surface roughness (0.176nm) and smooth interfaces are achieved. As an example optical application, we apply the multilayer system to fabricate a Si-based Bragg reflector. The specular reflectivity of one, two, and three-membrane mirrors is measured using FTIR. High specular reflectivity, above 99%, is achieved for three stacked membranes. Comparison of the measured reflectivity with theoretical calculations shows good agreement.

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Weina Peng
University of Wisconsin Madison

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