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Infrared Spectroscopy of the Elastically-Strained Silicon Nanomembrane Bonding Interface[1] ARNOLD KIEFER, WEINA PENG, DONALD SAVAGE, MAX LAGALLY, University of Wisconsin Madison — We investigate the bonding interface between elastically strained silicon nanomembranes (SiNMs) and new host substrates with Fourier transform infrared spectroscopy in efforts to elucidate its chemical structure. We create SiNMs by heteroepitaxial growth of straining layers on the template layer of silicon-on-insulator (SOI) and then releasing the membrane sandwich by etching away the buried oxide. We then bond the SiNM to a new substrate, in the present case oxidized Si. Because the SiNM is only nanometers thick, the bonding interface contributes greatly to the membrane's structural and electrical properties. We probe the buried interface by attenuated total reflection via the evanescent wave from a germanium prism in intimate contact with the SiNM, which penetrates through the SiNM to interact with the interface bonds. In efforts to understand bond strength and interface electronic states, we probe the influence of different cleaning procedures, gas treatments, and annealing steps.

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