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Elastic property characterization of oxidized Si nanowires by contact-resonance atomic force microscopy GHEORGHE STAN, ROBERT COOK, National Institute of Standards and Technology, NANOMECHANICAL PROPERTIES GROUP TEAM — The synthesis and processing of materials into nanostructures opens new avenues for advancement and diversification of current electronic, optoelectronic, and sensor applications. Among these structures, Si NWs are distinctly remarkable as they bring the previous decades knowledge of silicon technology into nanoscale applications. From this perspective, the characterization and understanding of the mechanical properties of nonplanar Si-SiO2 interfaces are of significant utility in developing Si nanostructures for Si-based integrated circuits. To investigate the elastic properties of as-grown and oxidized Si NWs we have extended and specifically tailored the applicability of contact-resonance atomic force microscopy (CR- AFM). From such CR-AFM measurements, the effect of the compressive stress at the Si-SiO2 interface was revealed in a diameter dependence of the elastic modulus of oxidized Si NWs. A modified core-shell model that includes the interface stress developed during oxidation captures the observed dependence. The values of strain and stress as well as the width of the stressed transition region at the Si-SiO2 interface agree with those reported from simulations and other experiments. This novel approach advances CR-AFM applicability in investigating structure-mechanical property relationships at the nanoscale.

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