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Temperature Dependence of the Dielectric Function of Germanium by Spectroscopic Ellipsometry[1] AMBER A. MEDINA, L.S. ABDALLAH, S. ZOLLNER, NMSU — The complex pseudo-dielectric function <e> of a two-side polished bulk germanium wafer was measured from 0.6 to 6.6 eV on a J.A. Woollam variable-angle spectroscopic ellipsometer. To obtain accurate results (especially in the near-transparent region of Ge below 2 eV), we employed a computer-controlled Berek wave plate compensator. The thickness of the native oxide was determined from the maximum of $<e_2>$ at 4.2 eV. The native oxide thickness of the as-received Ge wafer (3.7 nm) could be reduced to 1.6 nm by submerging the wafer in de-ionized water and allowing it to dry in air. After mounting the wafer in a UHV cryostat, the oxide regrew to 1.9 nm. By annealing the wafer at 700C for one hour under UHV conditions, this could be reduced to 1.7 nm. Finally, we acquired <e> as a function of temperature from 77 to 700 K. With increasing temperature, the interband transitions redshift and broaden due to the lattice vibration dampening of the electronic states. Measurements on a single-side polished Ge wafer (prepared by roughening the back surface with a bead blaster) and analysis of the second derivative of e to determine the interband critical-point parameters are in progress.

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