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Infrared spectroscopy of bonded silicon wafers

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Abstract

Infrared spectra of multiple frustrated total internal reflection and transmission for silicon wafers obtained by direct bonding in a wide temperature range (200-1100°C) are studied. Properties of the silicon oxide layer buried at the interface are investigated in relation to the annealing temperature. It is shown that the thickness of the SiO_2 layer increases from 4.5 to 6.0 nm as the annealing temperature is increased. An analysis of the optical-phonon frequencies showed that stresses in the SiO_2 relax as the annealing temperature is increased. A variation in the character of chemical bonds at the interface between silicon wafers bonded at a relatively low temperature (20-400°C) is studied in relation to the chemical treatment of the wafers' surface prior to bonding. Models of the process of low-temperature bonding after various treatments for chemical activation of the surface are suggested. © Nauka/Interperiodica 2006.