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Low Temperature Bonding of Si to Silicates using Langmuir-Blodgett molecular films as precursors for a bonding SilOxSi interphase MURDOCK HART, SHAWN WHALEY, JAMES BRADLEY, DAVID SELL, NICOLE HERBOTS, Physics ASU, ROBERT CULBERTSON, VASUDEVA ATLURI, Physics ASU — Low temperature (25 $^\circ$ C-200 $^\circ$ C) bonding between Si(100) and oxide wafers, either made of Silica or oxidized Si (100) is achieved through a dual wet chemical process which terminates the stabilized ordered (1x1) Si<100>wafer surface in air at room temperature with 2-D Langmuir-Blodgett film consisting of ordered arrays of O-H silanol group. The parallel wet chemical processing of the oxide surfaces renders the SiO2 subsotichiometric in oxygen and therefore hydrophilic surface polarization. When put into contact the Si and oxide surfaces are attracted to one another and consequently form a bond at room temperature. Cross-Bonding via chemical oxidation of the surfaces in contact requires the two surfaces to be brought within nano-meter separation distances to allow cross-bridging during re-oxidation of both surfaces and the formation of a new interphase between the two. The application of uniform mechanical compression to overcome the Coulomb force and decrease large-scale surface geometry warping in the wafer is critical. A 24 hour 180 $^\circ$ C anneal in controlled ambient air is used to activate the silanol molecular film on the (1x1)Si(100) surface and the oxidation process by which molecular bonds between the (1x1)Si(100) and SiO2 wafers are created.

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