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Defect-Free Strained Si-on-Insulator Structures G. M. COHEN, P.M. MOONEY, V. PARUCHURI, J.O. CHU, IBM T.J. Watson Research Center, H. CHEN, IBM Microelectronics Division — Unlike graded SiGe buffer layers that are used for strained Si devices, free-standing Si/SiGe/Si structures that undergo elastic strain relaxation are essentially defect free and can be used to fabricate strained Si-on-insulator (SSOI) slabs suitable for SSOI MOSFETs [1-3]. We present an alternative method to form defect-free strained Si-on-Si (SSOS) or SSOI slabs by in-place bonding. An SOI wafer having a pseudomorphic SiGe layer and a Si cap layer is etched to form slabs. As the buried SiO_2 layer is completely etched away, the Si/SiGe/Si slabs are bonded in place to the Si substrate in the etch solution. The slabs remain bonded to the substrate by van der Waals forces when the wafer is removed from the etch bath. X-ray diffraction and AFM measurements show that the SiGe layer has relaxed elastically, i.e. no misfit dislocations are formed, and that the Si layers are under tensile strain. Subsequent annealing at high temperature forms a covalent bond. This method allows direct bonding of strained Si to Si. By suitable choice of the layer structure of the starting wafer, bonded SSOI structures can also be fabricated. The different forces involved at each stage of this in-place bonding process will be discussed. 1. G.M. Cohen, et al., Mat. Res. Soc. Symp. Proc. 768, 9 (2003). 2. P.M. Mooney, et al., Appl. Phys. Lett. 84, 1093 (2004). 3. P.M. Mooney, et al., Mat. Res. Soc. Symp. Proc. 809, 27 (2004).

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