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Enhanced intervalley splitting and reduced spin relaxation in strained thin silicon films¹ DMITRI OSINTSEV, VIKTOR SVERDLOV, SIEGFRIED SELBERHERR, Institute for Microelectronics, TU Wien — We investigate the influence of strain and spin-orbit interaction on the valley splitting, subband structure, subband wave functions, and spin relaxation matrix elements due to surface roughness scattering in thin silicon films. A $\mathbf{k} \cdot \mathbf{p}$ approach suitable to describe the electron subband structure with spin [1] is generalized to include strain. The 4×4 Hamiltonian is diagonalized with respect to the spin degree by a unitary transformation. The wave functions and eigenenergies are found analytically, when the thin film is approximated by an infinite square well potential. In relaxed films the unprimed subbands are degenerate. This degeneracy produces a large mixing between the spin-up and spin-down states, resulting in spin hot spots characterized by strong spin relaxation. These hot spots are contrasted with those appearing in the bulk system [1] due to the degeneracy of the opposite valleys along certain directions close to the X-point at the edge of the Brillouin zone. Shear strain efficiently lifts the degeneracy between the unprimed subbands. This removes the origin of the spin hot spots in a confined silicon system, which substantially improves the spin lifetime in silicon films. 1.P.Li and H.Dery, *Phys.Rev.Lett.* **107**, 107203 (2011).

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