Addenda

On p. 50, in the fifth paragraph of section 4.2 beginning "Indentation was carried out using the UMIS-2000 indenter", the following line should be added after the last sentence: "Values were averaged from 16 tests. Where averaged hardness values are presented elsewhere in this thesis, a similar number of tests were used."

On p. 54, after the sixth paragraph of section 4.4 the following paragraph should be added: "The decrease in elastic modulus in the as-implanted specimens is also noteworthy. This drop is likely related to the high vacancy concentration after ion implantation. A similar decrease in elastic modulus with increasing vacancy concentration has been observed previously in other materials systems.[157,158] The presence of vacancies effectively reduces the number of bonds in a given volume of material, reducing the stiffness of the material."

On p. 68, in the first paragraph of section 6.2, the final sentence should read: "All films were thicker than the critical thickness for strain relaxation,[133] that is they all contained misfit dislocations, and were assumed to be free of significant internal stresses."

On p. 87, in the fourth paragraph of section 7.3.1, the first sentence should read: "A statistical analysis of the giant pop-in event was conducted using 400 P-h curves from 500 mN load spherical indents, made with the UMIS using 125 increments in the loading curve and 10 increments in the unloading curve."

On p. 112, after the third paragraph of section 8.3, the following paragraph should be added: "*In situ* electrical measurements have been used to monitor indentation-induced phase transformation in Si.[82,125,159] In this project two different approaches were tried to perform similar measurements on Ge, neither with entirely satisfactory results. The first approach was to indent through a reverse-biased thin metallic Schottky contact on top of the Ge, similar to that described in Ref. 159. In this geometry, the formation of a metallic phase beneath the tip creates an Ohmic conductive pathway, which lowers the overall resistance (measured from the top contact to an Ohmic back contact). The effective measured resistance is given by $R_{eff} = (1/R_c + 1/R_{rev})^{-1}$, where R_c is the resistance of the Ohmic region formed by indentation, and R_{rev} is the resistance of the remainder of the reverse-biased top contact.[159] It is obvious from this relationship that if the resistance R_{rev} of the contact is too low, it will dominate the measurement and wash out the contribution of R_c. In this project a sufficiently high-resistance top Schottky contact could not be obtained. This could perhaps be addressed by better surface preparation or different metals for the top contact (aluminium and gold were tried), or a smaller top contact. Preparing a high-resistance contact is intrinsically more difficult for Ge than Si due to its lower bandgap. The second approach was to use a through-tip electrical geometry with the Hysitron indenter, using a conductively-doped diamond tip. This approach eliminates the need for a top contact. However, with this approach there is no obvious way to distinguish a resistance drop due to metallic phase formation from a resistance drop simply due to increasing contact area or other factors, making results somewhat more challenging. Nonetheless, this is probably the most promising route for further *in situ* measurements on Ge."

On p. 127, the following references should be added: [157] Jiang, X., Wang, M., Schmidt, K., Dunlop, E., Haupt, J. and Gissler, W. Elastic constants and hardness of ion-beam-sputtered TiN[sub x] films measured by Brillouin scattering and depth-sensing indentation. *J. Appl. Phys.* 69(5): 3053-3057.(1991), [158] Jhi, S.-H., Louie, S. G., Cohen, M. L. and Ihm, J. Vacancy Hardening and Softening in Transition Metal Carbides and Nitrides. *Phys. Rev. Lett.* 86(15): 3348.(2001), and [159] Bradby, J. E., Williams, J. S. and Swain, M. V. In situ electrical characterisation of phase transformations in Si during indentation. *Phys. Rev. B* 67: 085205.(2003)