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Electron spin resonance and relaxation of defects and donors in Silicon Nanowires MARCO FANCIULLI, University of Milano Bicocca, Department of Materials Science, MATTEO BELLI, Laboratorio MDM, IMM-CNR, STEFANO PALEARI, ANTONIO PIZIO, University of Milano Bicocca, Department of Materials Science — The current status of the investigation of defects in silicon nanowires and at the interface between the group IV semiconductor and its oxide in 1D nanostructures is reviewed and discussed. The paper concentrates on nanowires produced by metal assisted chemical etching. Donors (such as P and As) and defects at the interface between the semiconductor and its oxide (namely, the Pb centers) are investigated by continuous wave (CW) and pulsed Electron Paramagnetic Resonance (pEPR). The role in the de-activation mechanism of donors played by hydrogen and Pb centers is discussed. The characteristic times, the spin-lattice T1 and spin-spin T2, of the Pb centers are also reported in this study. Their behavior as a function of the temperature is addressed in the framework of Two-Level-Systems. TLS are usually invoked wherever there is a disordered system, which in the case of Pb centers is represented by the amorphous oxide side. The model includes a low- and a high-temperature regime. It is worth noticing that bulk techniques such as CW and pEPR are applied to surface defects thanks to the enhanced surface-to-volume ratio. The results of the present investigation highlight a possible issue for the exploitation of nanostructures in fields like spin-based quantum computing, i.e. the spin-lattice relaxation and the decoherence induced by the TLS in the Pb centers.

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