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NANOWIRES – BUILDING BLOCKS FOR NOVEL DEVICES

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The purpose of the presentation is to illuminate several aspects regarding the synthesis of silicon and germanium NWs, their electrical and optical properties, and the fabrication of novel devices made thereof. Following an introductory survey of NW growth methods, experimental results concerning the epitaxial growth of nanowires are presented. The diameter dependence of the growth velocity and crystallographic growth direction of NWs, a parameter that is of great importance especially in view of the technical applicability of epitaxially grown NWs will be discussed.

Further we merged two of the most important nanostructures for future applications: quantum dots and NWs, which will result into nano-materials with superior functionality. The synthesis techniques are based on the use of phase separation as a vehicle for creating inhomogeneities within particular NW materials. Two promising approaches will be presented: (i) ion implantation beyond the solubility limits and subsequent flash annealing, as well as an approach based on (ii) controlled phase conversion by diffusion. The resulting "wired quantum dots" are comprehensively characterized using e.g. electron microscopy, X-Ray diffraction and μ-Raman spectroscopy.

The electrical and optical properties of the NWs will be shown. We demonstrate the integration of self-contacting and ultrascaled metal-semiconductor-metal NW heterostructures into various devices, ranging from quantum ballistic transport to plasmonics.

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