Materials, technologies and devices: InP and III-V

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III-V materials have the advantage over silicon of a direct bandgap which allows for optical amplification and short detectors. Further they have a higher electron-mobility as silicon, which gives them better rf-properties. The most widely used III-V semiconductors are based on InP, GaAs and GaN. InP is particularly suited for telecommunication purposes because it can generate and detect light in a wide wavelength range from 1.2 to 1.6 mm. Also for non-telecom application it is an interesting platform, however, because of the unprecedented functionality that it offers. In the lecture we will discuss the most important components available in InP-based integration platforms. The most important one is the optical amplifier. It is at the heart of a number of different lasers: tunable lasers, pulsed lasers and multi-wavelength lasers. Further InP supports a number of modulators: low-loss phase modulators, which are usually applied in a Mach-Zehnder structure to provide high-speed amplitude modulation, up to 50 Gb/s. Mach-Zehnder modulators are fairly long, in the order of 1 mm or longer. They have excellent chirp and loss properties. Much shorter high-speed modulators can be created by using the electro-absorption effect. Electro-absorption modulators have higher losses and more chirp, however. InP detectors are very compact and can have bandwidths well beyond 50 GHz. Propagation losses in passive waveguides are typically in the order of 2 dB/cm. In undoped waveguides they can be lower than 1 dB/cm. The most important passive components used in InP-based Photonic ICs are MMI-couplers and AWG demultiplexers. In the lecture the most important properties of the InP-based integration platform and its most frequently used components will be discussed.