Light coupling and performance of LC modulated photonic integrated circuits

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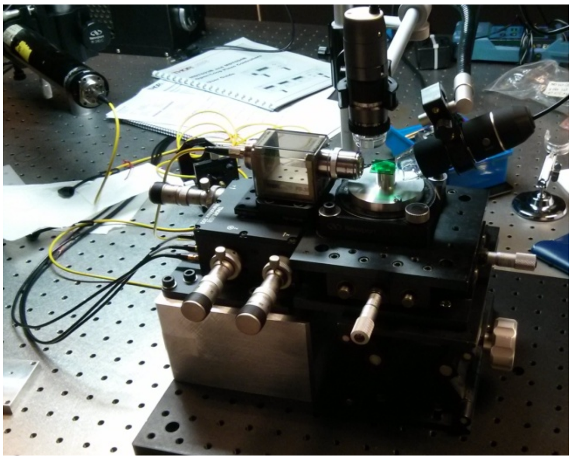
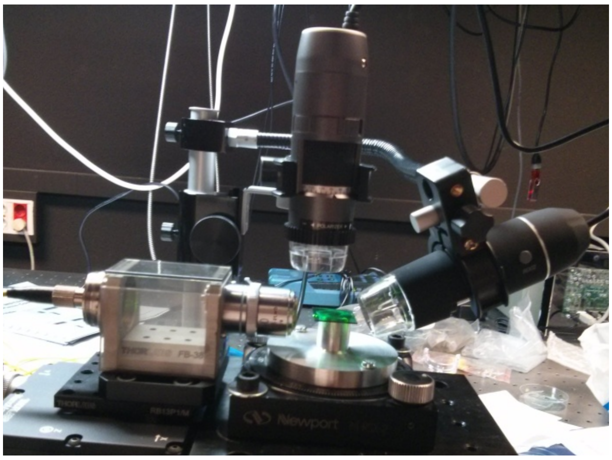
Coupling light into a photonic integrated circuit (PIC) is usually the most challenging task to characterize these circuits. PIC connections between components are made of light waveguides whose section is often of the same order as light wavelength, i.e., 1-5 μm or even less. Waveguides may become active by inserting additional layers of electrooptic materials [1], either as a component within the light path, or deposited onto the waveguide affecting the evanescent field of the guided light. Testing the light behavior inside the PIC and comparing the experimental results with those predicted in modeled circuits may be hampered by the tiny cross-section of the waveguides –especially monomode guides– and the arduous light coupling from external sources.

The issue may be faced up from several point of view. We are developing alternative systems where light is coupled by diffractive elements or generated internally. Moreover, we are developing improved versions of classical coupling setups. The figures show one of our latest realizations, consisting of an x-y-z electrically controlled nanopositioned microscope objective, green/red He-Ne lasers and two microscopes. The piezoelectric nanopositioner focuses visible light onto the input waveguide, where one of the microscopes is placed. The second microscope is used to extract the light signal from the opposite end, being eventually brought to the detection system.

[1] Morrissey, P. E., Kelly, N., Dernaika, M., Caro, L., Yang, H., & Peters, F. H. "Coupled Cavity Single Mode Laser based on Regrowth–Free Integrated MMI Reflectors". IEEE Photonics Technol. Lett. 28 (12) 1313-1316 (2016).

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