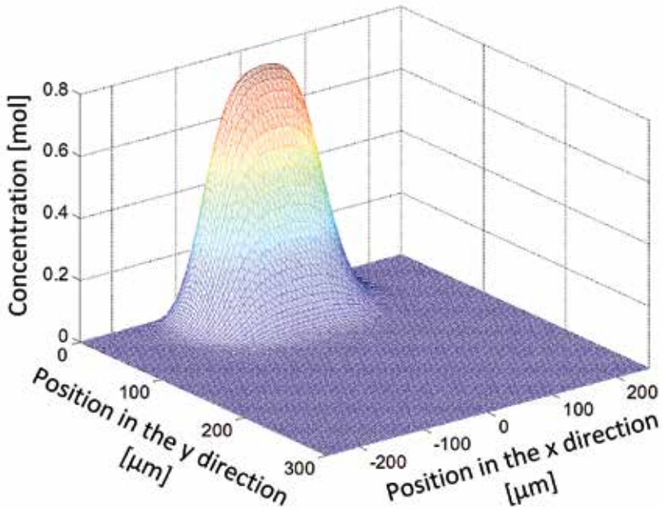
Modelling and Optimizing the Ion-Exchange Process for Manufacturing Optical Waveguides

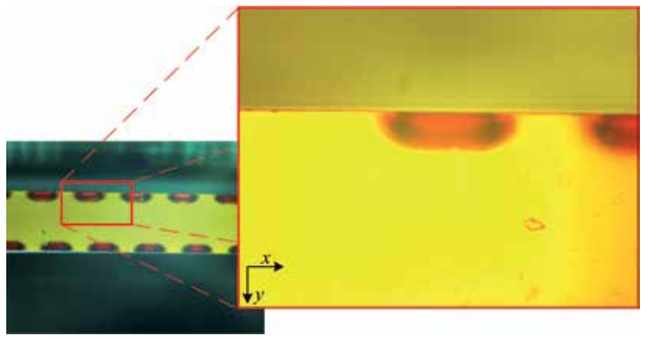
Since more than 10 years, the research group led by Prof. Griese, has consistently investigated on the potentiality of using optical multimode waveguides on printed circuit boards (PCBs). During these years extensive experience in design, simulation, producing electrical-optical circuit boards (EOCBs) and optical interconnections from different BMBF supported collaborative research projects has been gained. In 2010, they started a new creative project with TU Berlin to model and optimize ion-exchange processes in order to produce optical components with GI-Profile in thin glass substrates.

For over a century ion-exchange techniques have been used to produce tinted glasses. But in recent years this technique catches increased attention, as it creates a waveguide region in glass, which exhibits the competitive ability in areas like sensor technology, optical signal processing and optical interconnection, because of their compatibility with optical fibers, low loss propagation and the ease to integrate into system. Using the ion-exchange technique makes it possible to meet the requirements of optical chip-to-chip-interconnection, which is the future trend in SIP (System in Package) and has been added as a volume technology in 2011. However, producing glass waveguides by using ion-exchange technique is a multi-parametric process, the modeling and technical implementation is highly complex. A central outcome of the project is the derivation of an optimal technical process from an optimized optical design. During simulations and experiments the physics and chemistry of the diffusion process and the connections between different simulation approaches will be deeper understood. As a result, it will be possible to obtain the optimal process parameters from the optical components with expected properties.

In the project the main task is to generate the models and algorithms by using numerical analysis to describe ion-exchange processes. The results will be used to optimize the process parameters.



The concentration-profile of exchanged ions in glass (cross section of waveguide).



The cross section of a waveguide array, which was produced by using ion-exchange process, and its partial enlargement.

I Project Management and Execution

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