# Single Step Fabrication of an Integrated Polymeric Waveguide

Sitanshu Gurung, Proyag Datta and Jost Goettert

[1]Center for Advanced Microstructure and Devices, Louisiana State University,
6980 Jefferson Hwy, Baton Rouge, LA 70806

## ABSTRACT

Optical detection is one of the most common methods of detection in microfluidic systems[1]. An optical waveguide is a viable means of delivering optical energy from one point to another in a microfluidic chip. A waveguide typically consists of two optically transparent materials with the material of higher refractive index forming a core and a material with lower refractive index forming the cladding. Such a structure is commonly seen in optical fibers.

Different methods exist for integrating optics into a microfluidic chip – glass optical fibers can be embedded into polymer chips or polymeric waveguides may be patterned in parallel with the microfluidic chip[2]. These solutions require multi-step processes, different polymers and a lot of time to fabricate.

In this paper we present a low cost, disposable, easily to fabricate optical waveguide directly integrated into a polymer microfluidic chip. Poly methyl methacrylate (PMMA) has been used to fabricate the waveguide and its design consists of a micro-fluidic channel with a cross-section as illustrated in Fig 1a. A thin layer of polymer forms the bottom floor of the channel. This thin layer of PMMA (higher refractive index) acts as the core while the air below it and aqueous biological media on the top (lower refractive index) act as cladding. This whole structure forms an optical waveguide. Unlike previous works in which light is usually delivered to a small region of the microfluidic channel using glass optical fibers or polymeric waveguides [3], light here is delivered over an extended region, along the length of the fluidic channel.

The fabrication involves a double sided hot embossing process (Fig 1b) using a Jenoptik HEX02 [4] hot embossing machine. Embossing is done above the glass transition temperature of PMMA. After embossing the chip is cut, polished, washed and sealed.

We successfully demonstrate fabrication of this combined opto-fluidic chip employing aligned hot embossing technology and will discuss preliminary experimental results using these chips for fluorescence detection of biological samples.

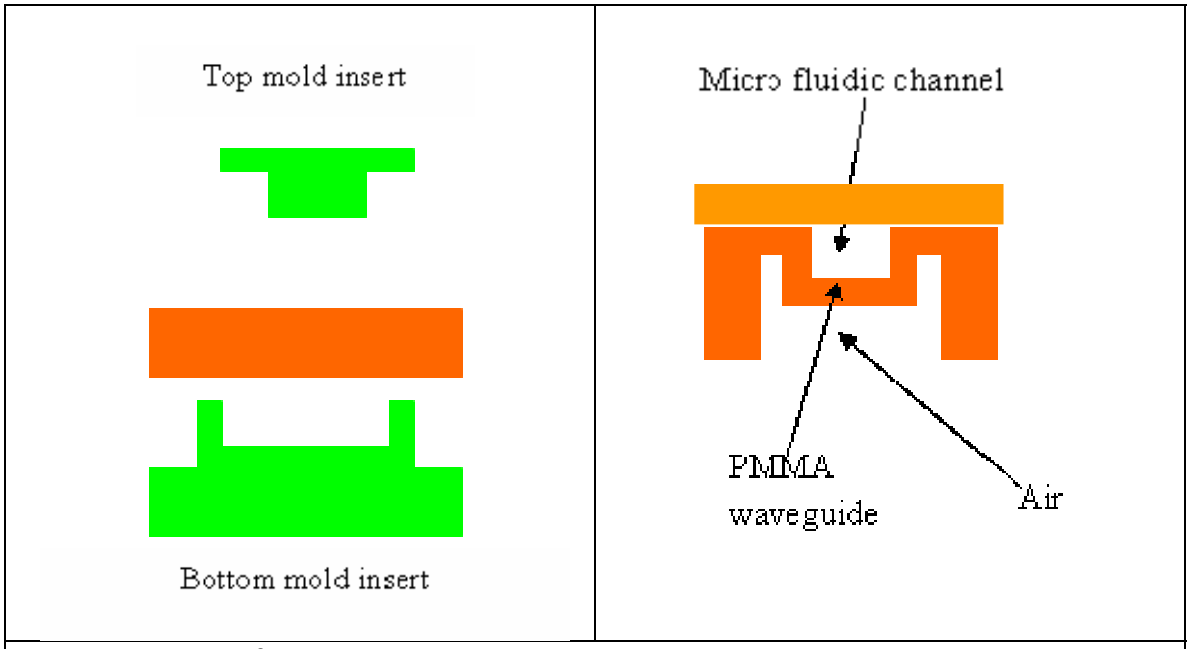


Fig1: Schematic of molding

**References**

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