POLITECNICO DI MILANO

Laboratory of Nanostructured Fluorinated Materials

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SELECTIVE ETCHING OF FUSED SILICA WITH LOW PRESSURE GASEOUS HYDROFLUORIDRIC ACID

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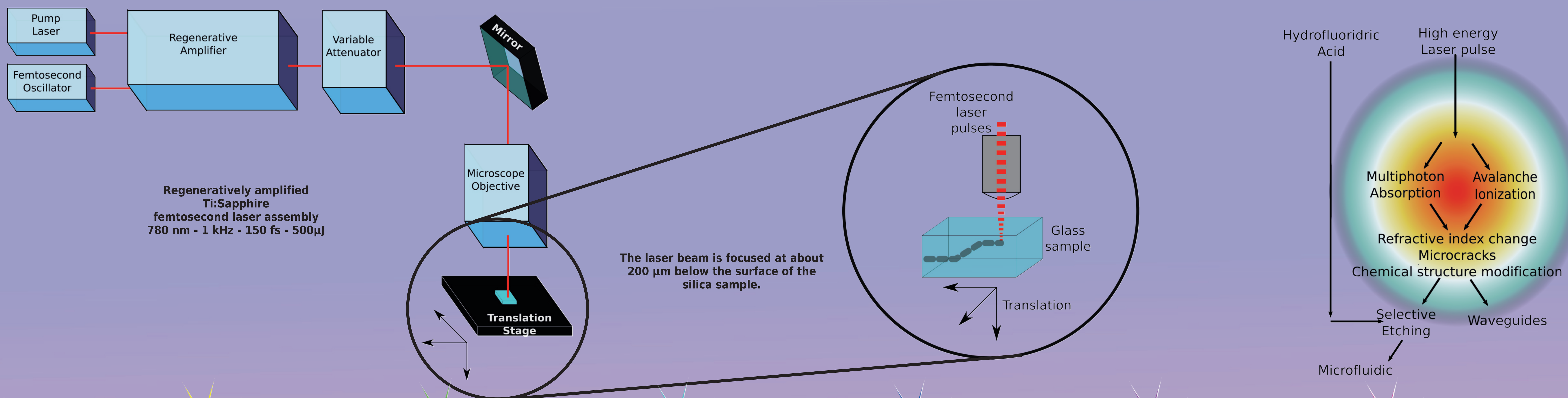
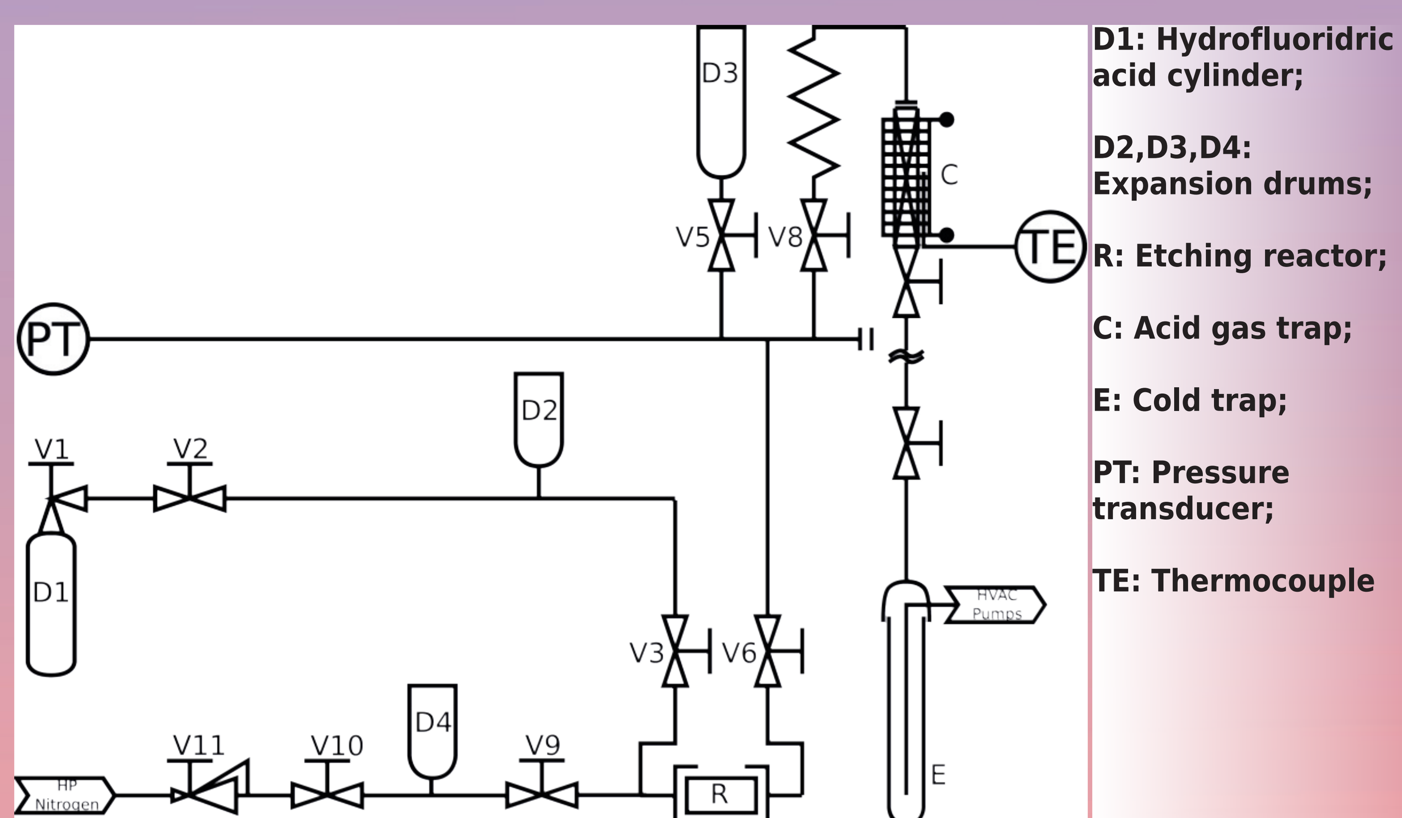
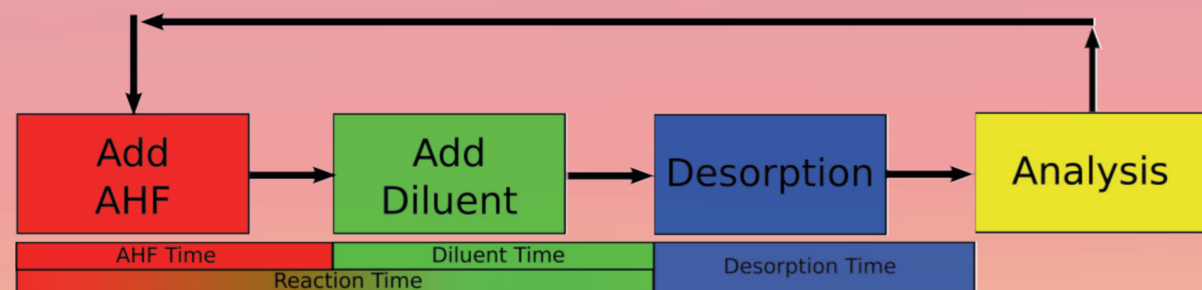
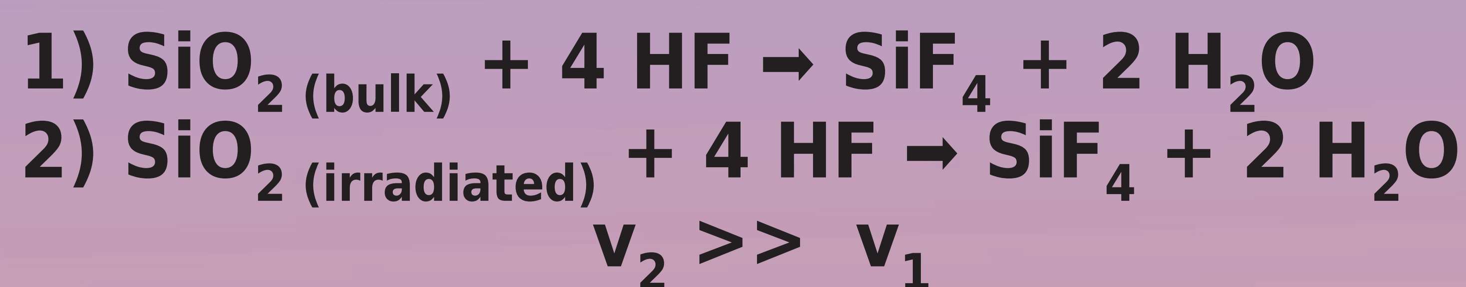
Three dimensional laser irradiation



Selective etching







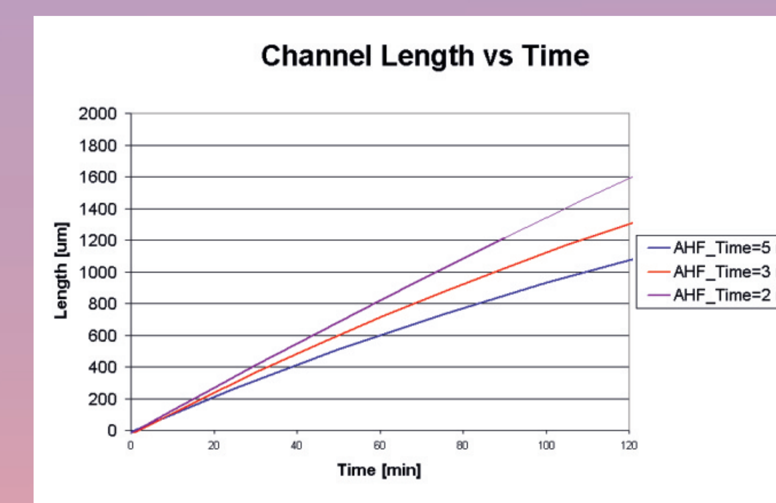
We report on the fabrication of microfluidic devices using a novel technique based on high-energy femtosecond laser irradiation followed by selective removal of the irradiated region by gaseous chemical etching.

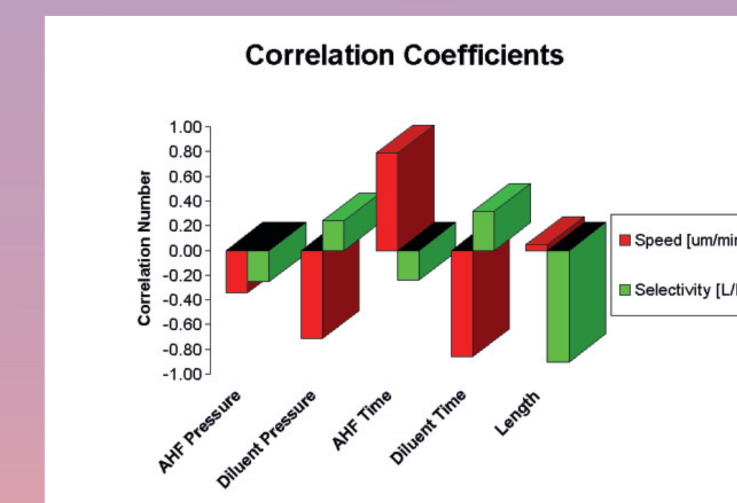
The microfluidic channels in commercial biochips are currently fabricated using intrinsically two-dimensional techniques borrowed from semiconductor processing thus creating surface channels that need to be covered by a glass slab so multilayer processing is required to produce three-dimensional structures.

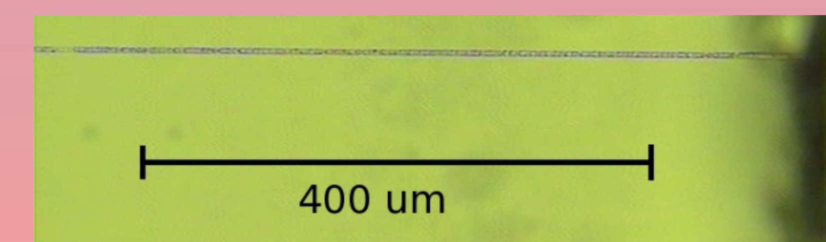
Recently, femtosecond laser assisted micro machining has emerged as a revolutionary technique for three-dimensional microchannel fabrication in glass. The procedure attested in literature consists of laser irradiation of the silica sample followed by chemical etching using an aqueous solution of hydrofluoridric acid.

The main constrains that currently affects the aqueous hydrofluoridric etching procedure are the minimal length and the low aspect ratio of the obtainable micro channels utilizing this procedure. The above limitations are mainly due to diffusion constrains of the etching reactants and products respectively in and out of the growing channel.

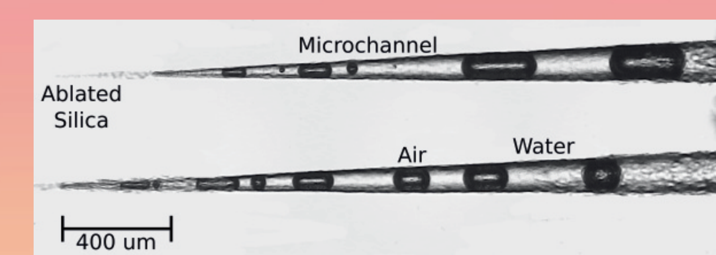
To overcome the diffusion limits and consequently realize longer microchannels with high aspect ratio, we have investigated the use of low pressure gaseous anhydrous hydrofluoridric acid (AHF) as etching agent, as well as the dynamic use of inert dilution gas.







Snapshot taken after laser ablation



Snapshot taken during selective etching reaction:

Maximum channels depth 2.8 mm
Maximum channels inlet diameter 115 um

All results presented are still unpublished.
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