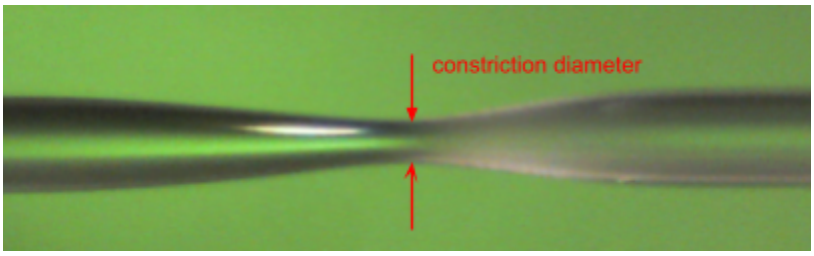
By Tiberius Brastaviceanu, add your name here

Glass constriction transducer fabrication



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Sensorica is an *OVN*, designing, producing and distributing optical fiber-based sensors.

Contents

Goal

Design a method and a device to manufacture glass fiber **constriction transducers**.

Important links

[Project page]
[Polymer fiber constriction]
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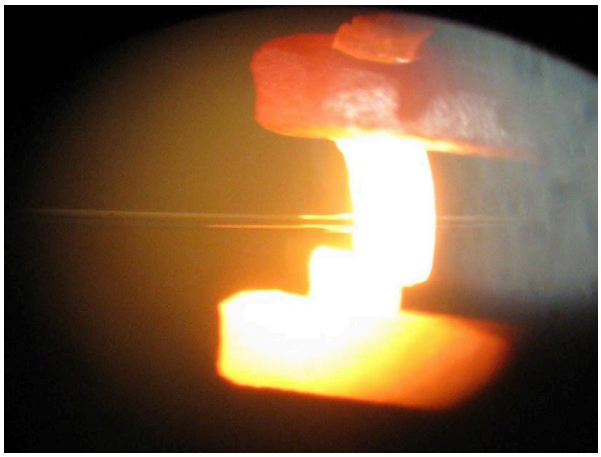
Background

First tests were started by Tibi and Jonathan using tungsten.
[work party 7 March 2012] tungsten
[work party 26 March 2012] platinum

Both experiments failed because of rapid oxidation of the tungsten heating filament, or not enough heat generated by the nickel-chromium or the platinum filament



Jonathan using the splicer. Tibi started to play with it after. Joel (intern) did some work on it too. This experiment was successful. Transducers were made and tested with a LD Mosquito and an LED Mosquito. See video. Optimisation studies were started by Tibi.	

General description of the tool

The constriction device

We modified a fiber splicer to do fiber constriction.

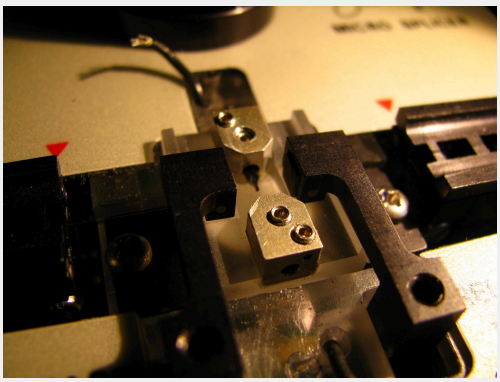
The fiber splicer being modified

Zoom into the region with the microtweezers

Power supply

The fiber splicer was modified to be powered by the GQ power supply


DC POWER SUPPLY
0.00
3.00



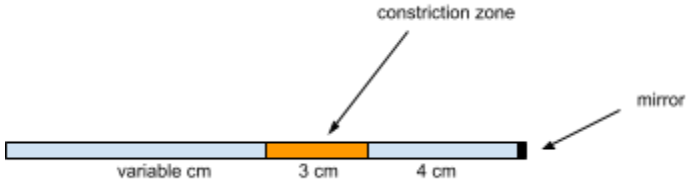
Procedures

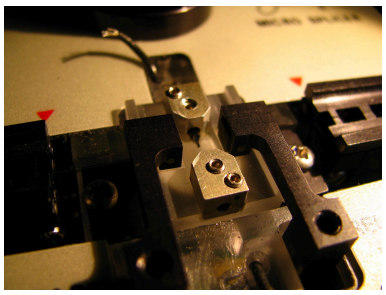
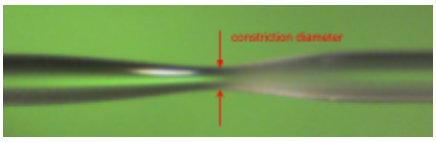
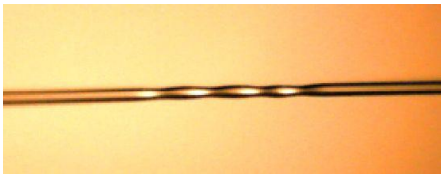
Setup and materials

Materials

- Fiber splicer to heat and pull the fiber.
- GQ power supply to power the splicer
- Stereo microscope: the microscope was used for inspection
- Camera: to take pictures and to take measurements. You can use a pixel ruler for distance measurement on the picture. The glass fiber diameter of 125 microns was used as a reference.
- Fiber preparation tools and materials
    - fiber stripper
    - fiber cleaver
    - 99% alcohol and optical tissue for cleaning the fiber

Protocol

Cut a piece of the fiber, strip the fiber on the portion of its polymer jacket, only its constriction zone (as in the picture below), using the fiber stripper, and clean stripped zone with 99% alcohol, using the special optical tissue. 	fiber stripper 

Place the fiber into the Splicer. Make sure it is well hold in place on both sides, because you want to pull-stretch it later. Set voltage to the GQ power supply to 9-10V and current to Max. Make sure the power supply is in high current mode. Adjust the zapping time one the splicer to 4-5 seconds.	
Zap and pull. During the zapping the fiber melts and you need to pull it using the manual stage of the splicer. The more pulling the smaller the constriction diameter. Some studies were made for diameter optimisation for a MM glass fiber constriction transducer. Multiple constrictions zones can be made.	 
Cleave the fiber on one side, using the fiber cleaver. NOTE: never use the cleaver on a fiver that has not been properly cleaned.	fiber cleaver 

Automated device design

This is based on a platinum filament. It needs a VERY precise timing of heating the filament and piezo-driven pulling of the fiber right on time. We can use the Arduino to control it.

Protocol

- Current ON - to heat the platinum element, need sub-ms-precise duration control for heating time
- Piezo ON - sets the piezo in motion, constant speed, for a few micons (10 to 50 microns), the Pieso ON time occurs at a precise time after Current ON, need sub-ms time resolution. Jonathan has an **optocoupler** that can be sued as a switch.
- Piezo OFF
- Current OFF

The preparation of the fiber (cleaning, cleaving, coating) will be done manually. The placing/positioning of the fiber in the device will also be done manually. Cleaving and coating must be done after constriction.

Program to drive it

We can use the LabJack U3HV for controlling the device the power supply, with a LabView program, with PWM Output.