



GDAŃSK UNIVERSITY  
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# Application of polymer optical fiber sensor for urine parameter measurements: a preliminary study

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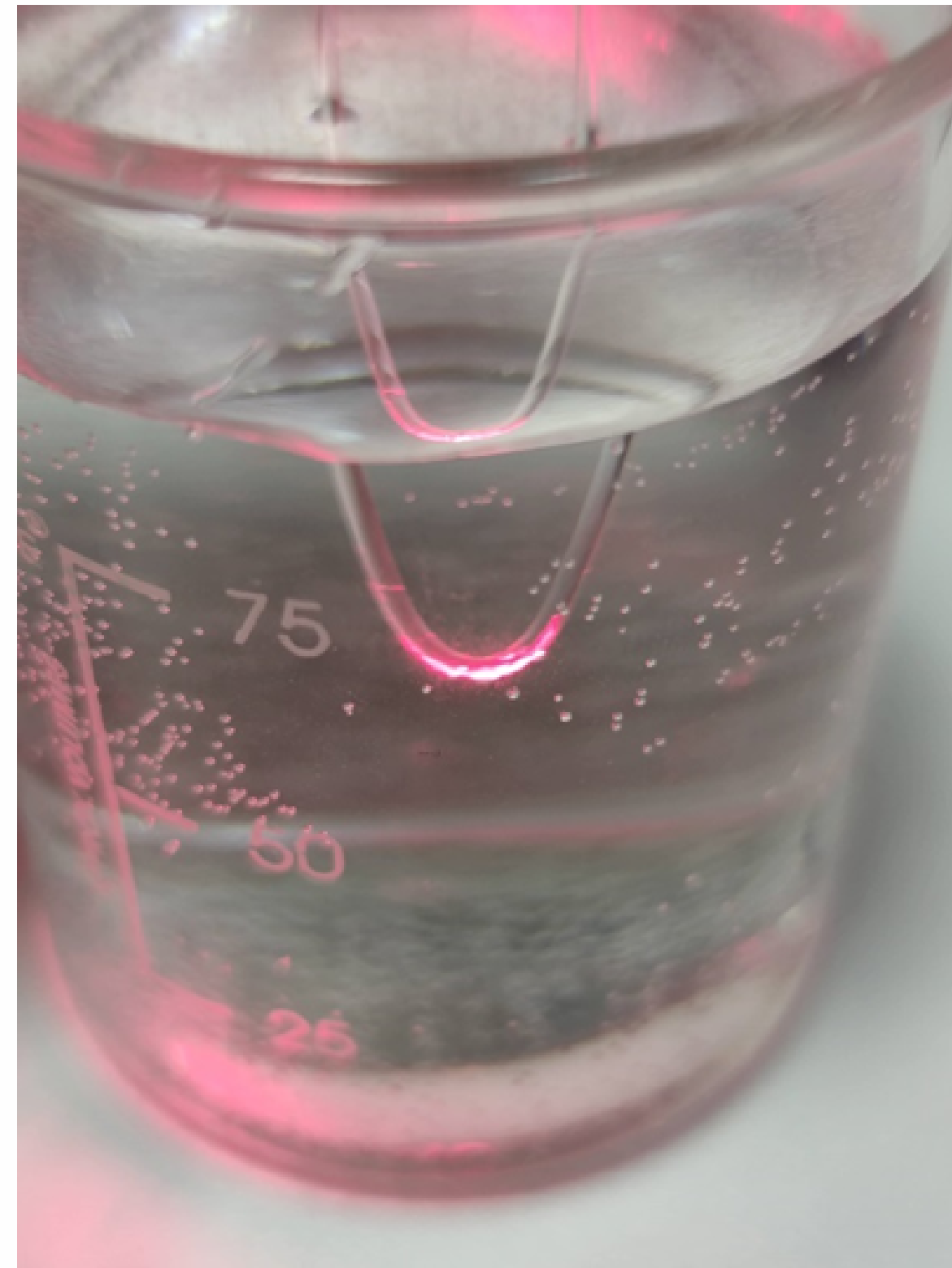
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## INTRODUCTION

In preliminary study we prepared U-Shape fiber, which is bent fiber sensor and mainly based on intensity modulation. For intensity modulation, changes are detected by optical loss, which can be changed through coupling condition, optical absorption characteristics, evanescent field.

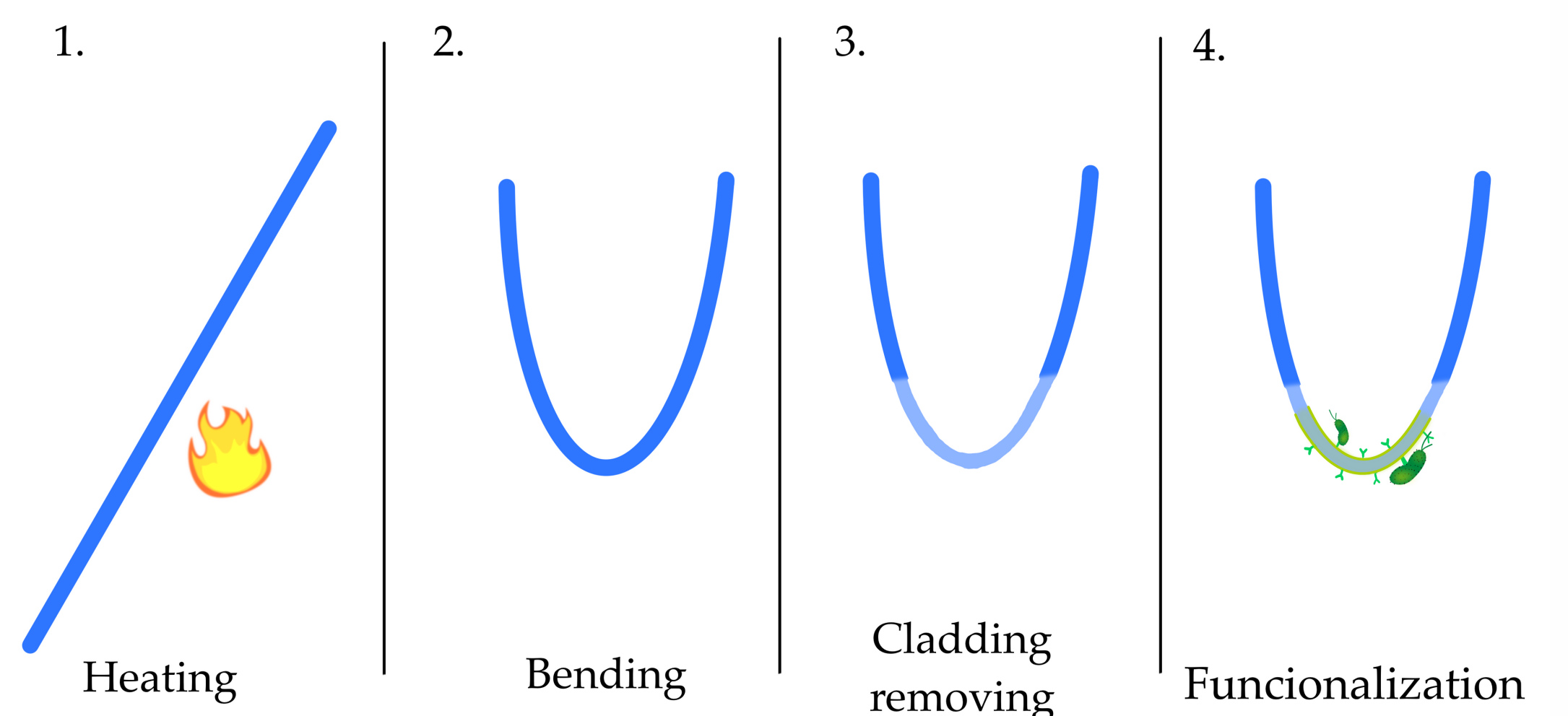
There are numerous beneficial properties of polymer fiber, such as small size, flexibility, biocompatibility, immunity to electromagnetic interference, capability for direct optical measurements and ease of coupling light into fiber.

## SENSOR



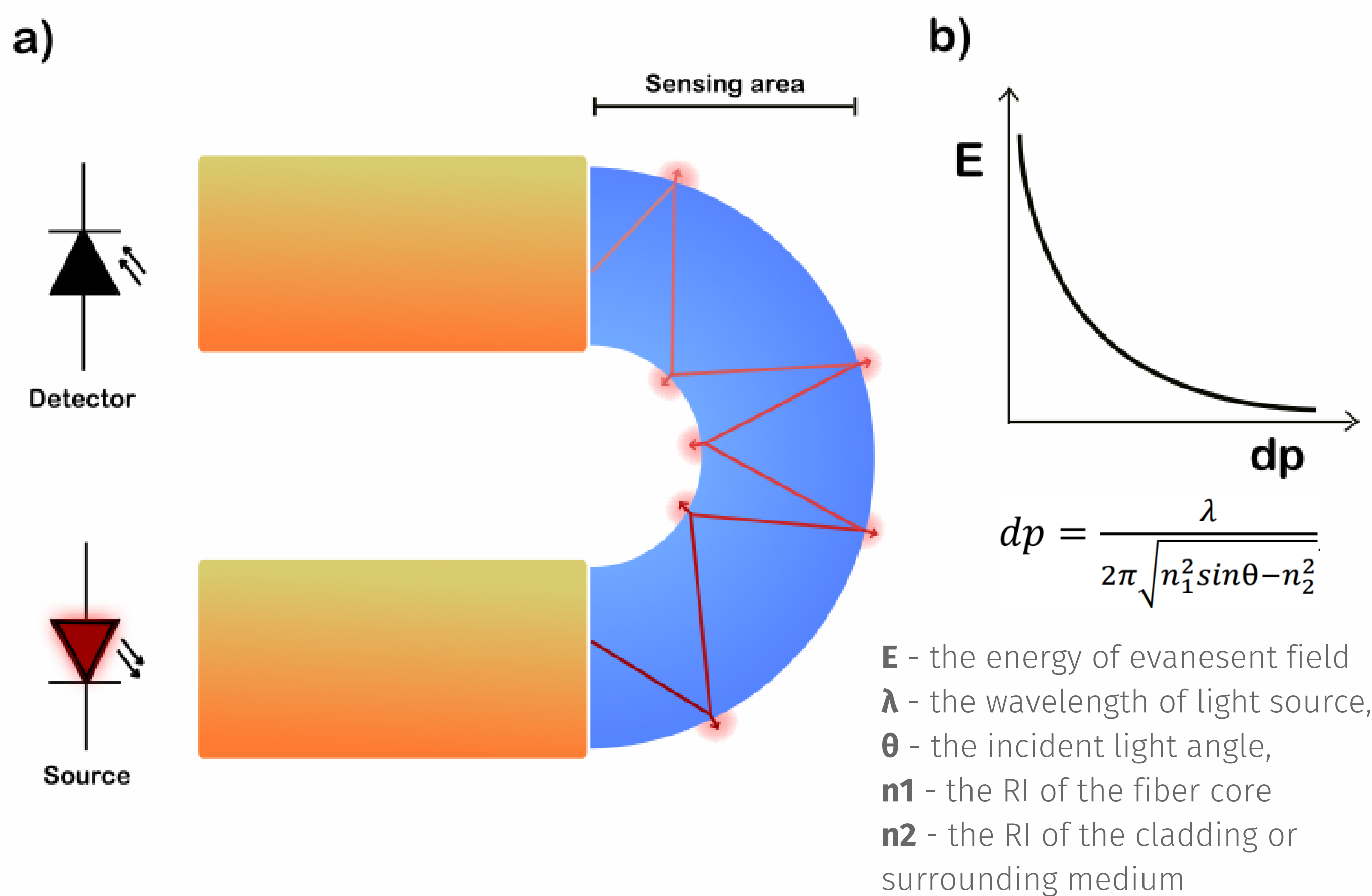
## FABRICATION PROCESS

In order to improve the accuracy of the sensor, the part of the cladding was removed. The sensor can additionally be modified by applying additional layers, e.g. for bacteria detection.



## PRINCIPLE OF WORKING

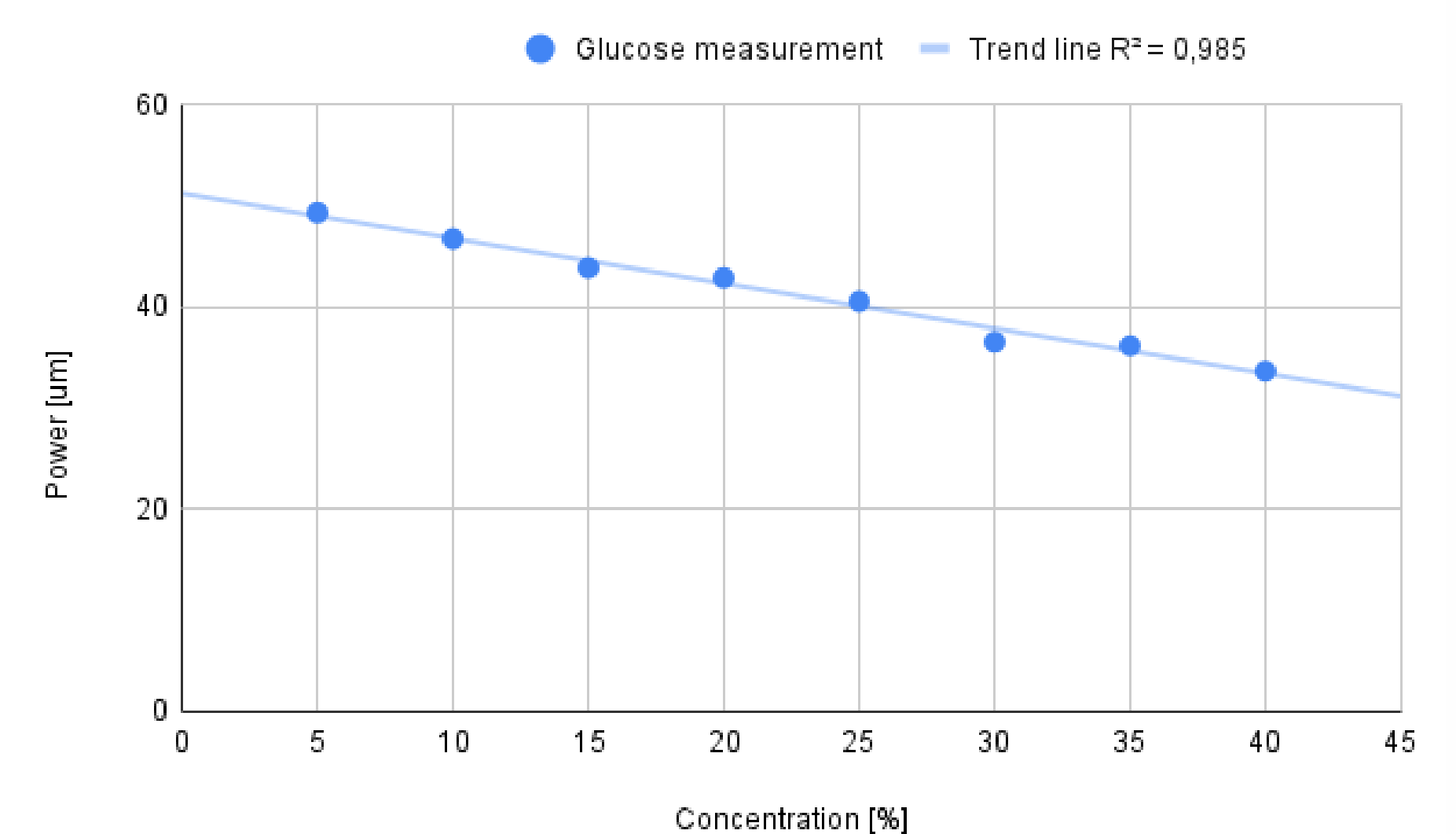
Light is transmitted in optical fibre in the form of total internal reflection. According to Maxwell's equations, there is still some energy in the low RI cladding or surrounding medium. It is a electromagnetic wave, called evanescent wave (EW).



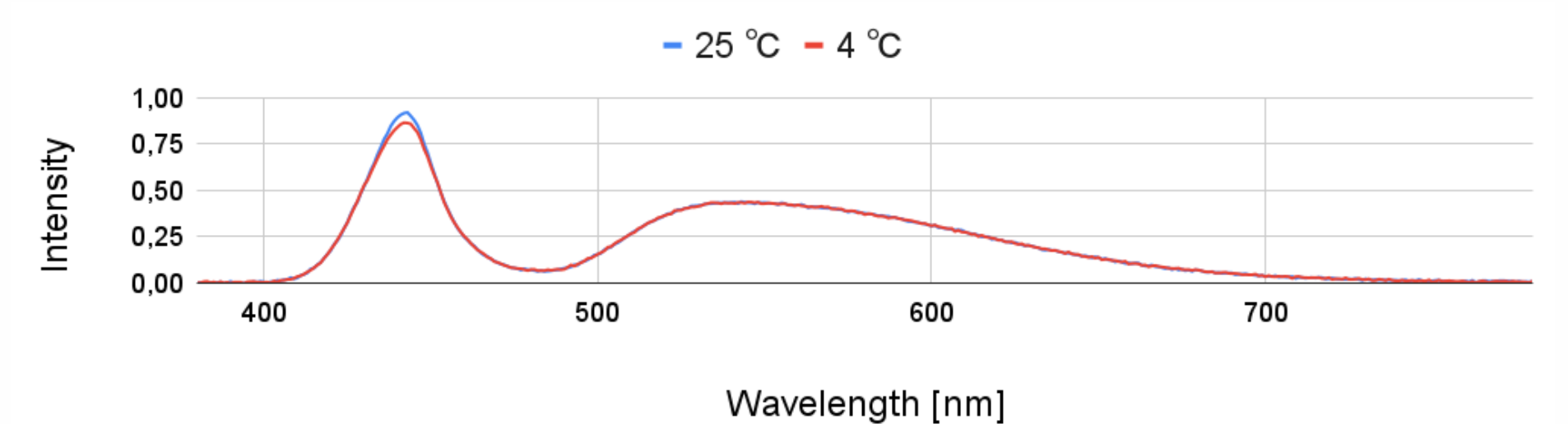
When penetration depth (*dp*) is large enough, the interaction between the evanescent field and external substances will be enhanced, and the energy loss of the evanescent field will be excited. Therefore, the external information can be detected by measuring the intensity. It is the sensing principle based on evanescent field. Higher evanescent wave power leads to higher sensitivity, given that more evanescent wave available to interact with the surrounding medium

## MEASUREMENTS

A solution with sugar was chosen for the test measurements. The RI in the range of about 1.32 to 1.39 for concentrations from 5 to 40%.



Spectrum variation associated with temperature change



## CONCLUSION

U-shape fiber sensors leads to the creation of new applications. The advancement of technologies for the ways of functionalization and geometrical modification provides numerous opportunities for the modification and optimization U-shape sensors.

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