

DEVELOPMENTS TOWARDS A MINITURIZED SMART SYSTEM FOR LIGHT STIMULATION AND MONITORING OF WOUND HEALING PROGRESS IN EU PROJECT MEDILIGHT



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Chronic wounds represent a significant burden to patients, health care professionals, and health care systems, affecting over 40 million patients and creating costs of approximately 40 billion € annually. The goal of the project MEDILIGHT is to develop a smart-self adaptable system which will provide personalized light therapy treatment to patients with chronic wounds.

MEDILIGHT Collaborative Project

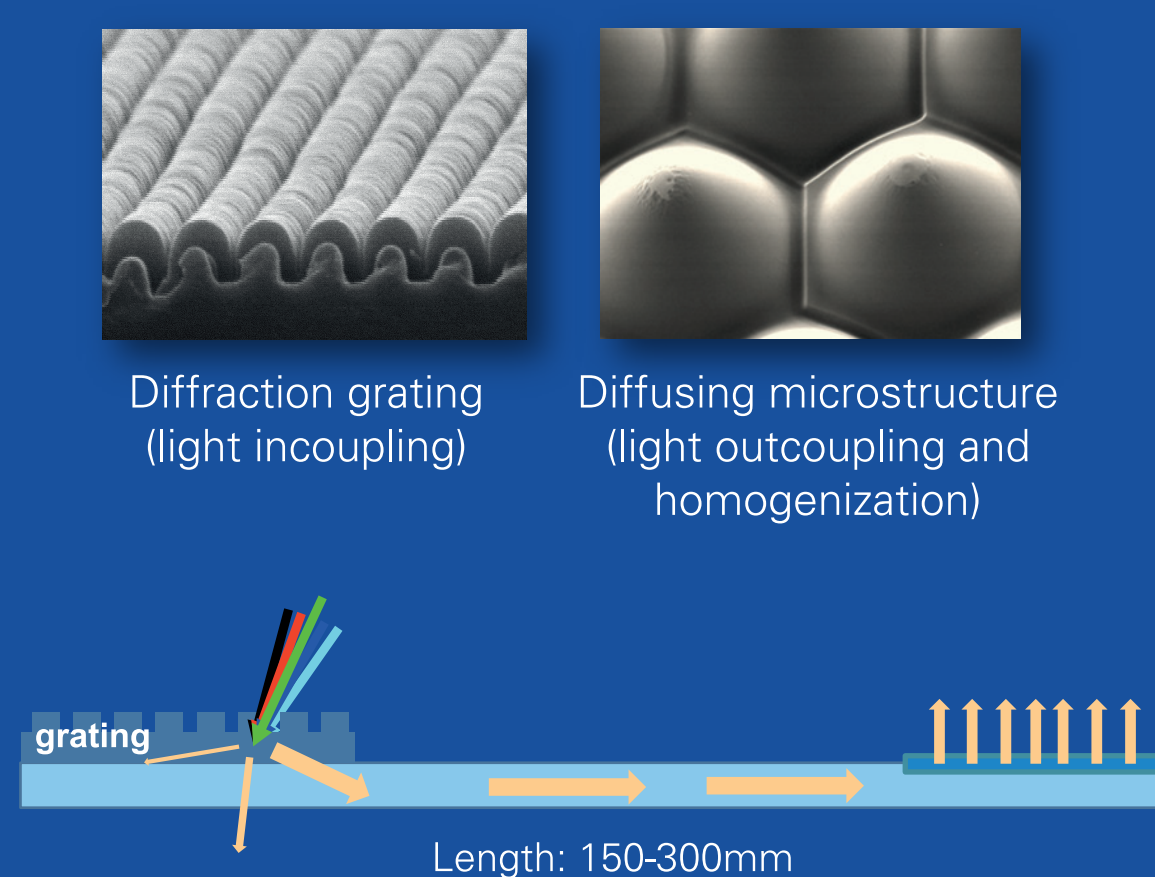
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 644267, project MEDILIGHT. It is coordinated by the Technical University of Berlin (TUB). The project has started in February 2015 and is conducted over a period of 36 months with an EU contribution of € 3.2M.

MEDILIGHT builds on the competencies of the following seven partners: Technische Universitaet Berlin (TUB), Germany; URGO Recherche Innovation et Developpement, France; Ruprecht-Karls-Universitaet Heidelberg, Germany; Centre Suisse d'Electronique et de Microtechnique SA (CSEM), Switzerland; SigSignalGeneriX Ltd, Cyprus; Microsemi Semiconductor Limited, United Kingdom; and AMIRES s.r.o., Czech Republic.



The first technological approach to bring light into the wound is based on waveguide materials and LEDs

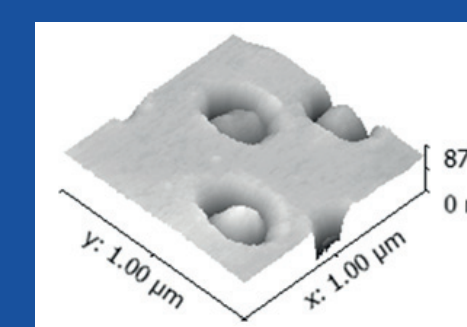
Waveguide Design



Selection of Waveguide Material

The following properties are desired:

- high optical clearness
- low scattering
- good surface quality
- highly flexible / bendable
- not sensitive to humidity (swelling, etc.)
- easy to be embossed / injection molded

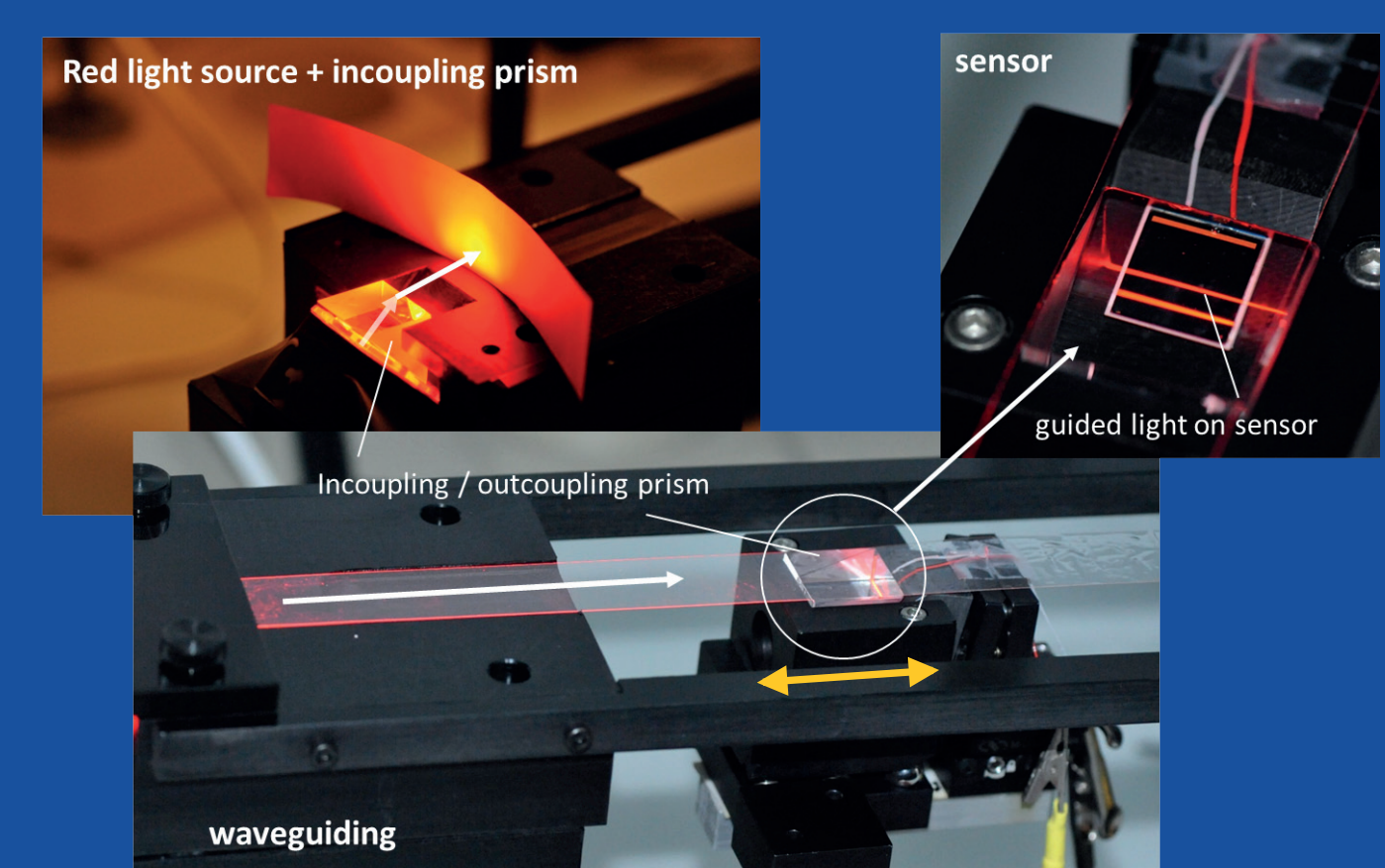


Example: Surface of a measured PMMA sample

- Different materials were tested: PET, PMMA, PC, COP (different types of each)
- Thick glass served as optical reference

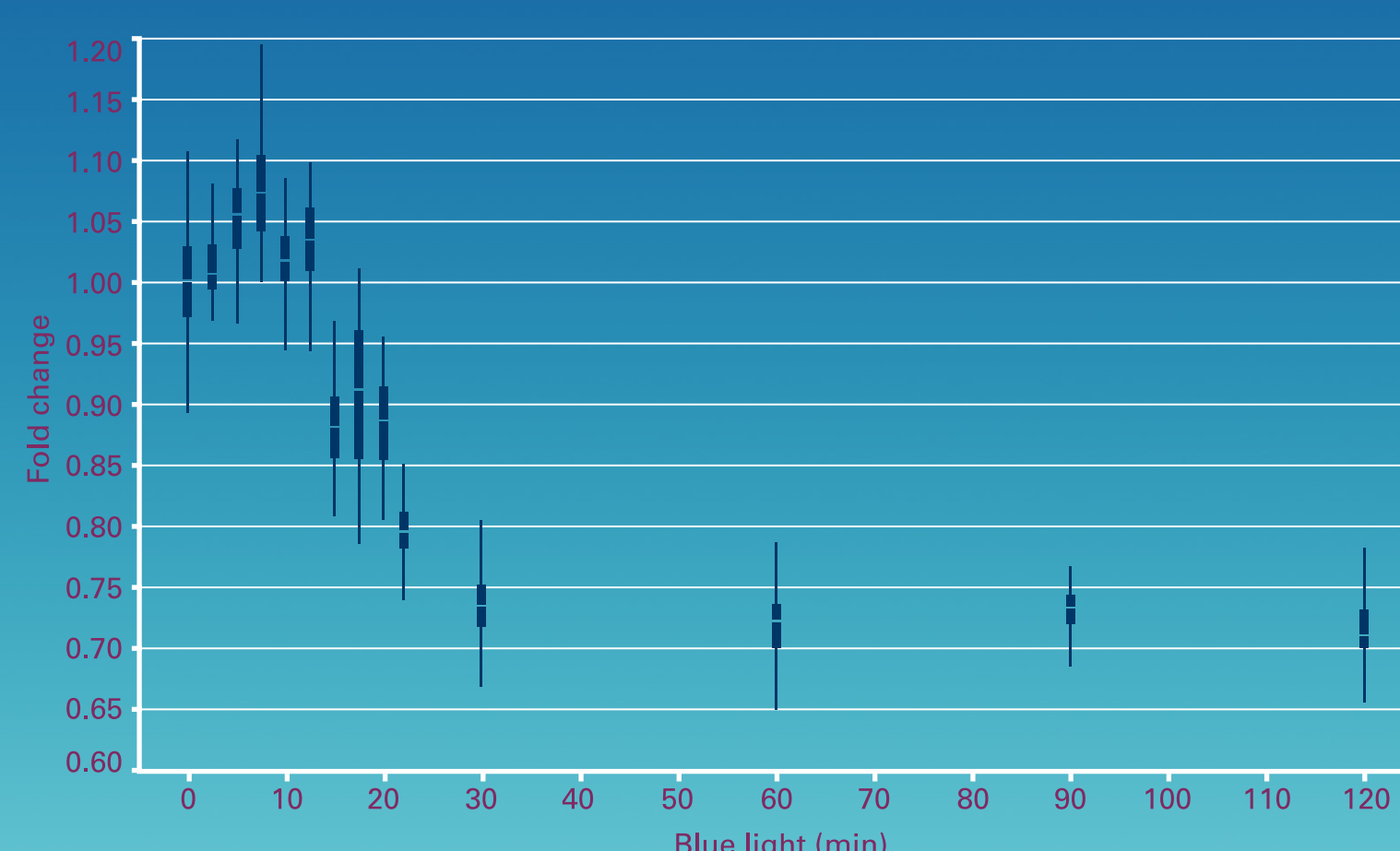


Measuring of Waveguide Efficiency



Biological results of blue light on cutaneous cells

Analysis of keratinocyte proliferation under blue light : 2 opposite effects of blue light in function of the light time irradiation : pro-proliferative effects or inhibition of the proliferation



Proliferation is measured by XTT test. Irradiation is done by a blue LED lamp (453 nm) at 23 mW/cm²

Clear anti-inflammatory effect of the blue light, revealed gene expression analysis. The anti-inflammatory effect of blue light is key for the healing-ability of the wound

Name	N° of genes	Enrichment score	NOM p-Value	FDR q-Value
Steroid hormone biosynthesis	46	0.69	<.001	<.001
Metabolism of xenobiotics by cytochrome P450	63	0.64	<.001	<.001
Electron transport	352	0.39	<.001	0.079
Melanoma	70	-0.41	0.007	1.000

Gene expression analysis 24h after 30min blue light irradiation. The last four columns present the number of deregulated genes, enrichment score, probability values without adjustment and false discovery rate with adjustment of multiple testing.

Key points

- MEDILIGHT project first results showed promising biological results with blue light on fibroblasts and keratinocytes, key cells for wound healing. Future investigations will focused on the effect of red light on cutaneous cells and the effect of both blue and red light on pathogenic bacteria, in order to eliminate the wound infection.
- Sensors of oxygenation and temperature will be developed to adapt the light illumination of the wound in response to the wound healing status.
- Automated control of light stimulation scheme is to be implemented in device, selection of profile and editing of user settings will be possible using smartphone or PC via Bluetooth V4.1.