Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

Institute for Applied Laser, Photonics and Surface Technologies ALPS

Prof. Dr. Patrick Schwaller

www.alps.ti.bfh.ch

Bern University of Applied Sciences
Pestalozzistrasse 20, 3401 Burgdorf / Switzerland

Research institutes of the department

- ES: Energy Systems
- HUCE: Human Centered Engineering
- IBM: ICT-based Management
- ***ALPS: Applied Laser, Photonics and Surface Technologies***
- IFMS: Mechatronic Systems
- MCT: Mobile Communication Technologies
- IPT: Printing Technology
- i-REX: Risk Management
- RISIS: Security in the Information Society
- TPT: Transportation

See www.ti.bfh.ch/en/research for more information

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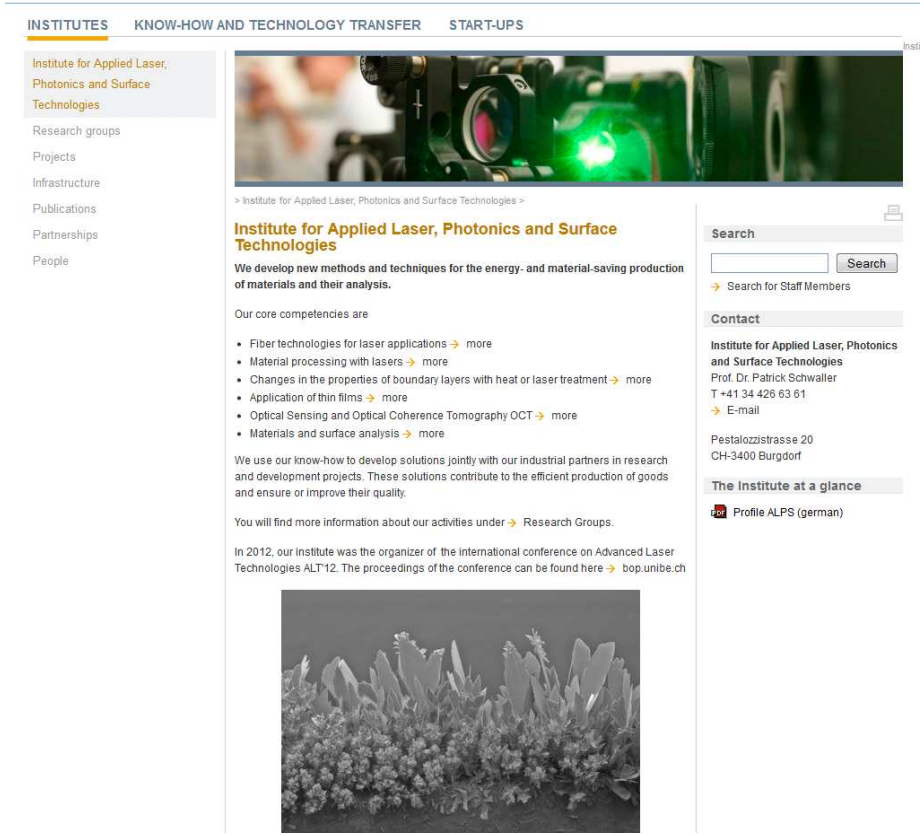

see also: www.alps.ti.bfh.ch

Third party funding 2012: CHF 2 Mio

ALPS is doing applied research in the domain of modification and characterization of surfaces and materials

Our tools & competencies:

- Different Laser systems with short pulses
- Thin film depostion techniques
- Heat treatment of materials
- Clean Room lab (ISO 6)
- Analytics (Mainly topography)

6 research groups with about 30 people in Burgdorf and Biel:

- Applied Fiber Technology
- Materials Technology & Heat Treatment
- Laser Surface Engineering
- OptoLab
- Materials Analysis
- Thin Films & Surfaces

Application domains:

- Medical Technology
- Mechanical Engineering
- Printing technology
- Watch industry
- Etc…

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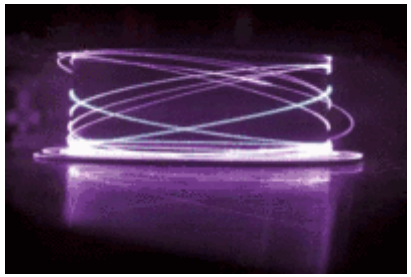
Research Groups @ Site Burgdorf:

Laser Surface Engineering:

- Prof. Dr. Beat Neuenschwander
- Prof. Dr. Guido Bucher
- Dr. Marc Schmid
- Dipl. Phys. Benjamin Lauer
- BSc. Beat Jäggi
- BSc. Peter Cam



Applied Fiber Technology:

- Prof. Dr. Valerio Romano
- Dr. Andreas Burn
- Dr. Sönke Pilz
- Dipl. Phys. Julia Boas
- Reto Augsburger

Thin Films and Surfaces:

- Prof. Dr. Patrick Schwaller
- MSc. Michael Held
- BSc. Sarah Zehnder
- BSc. Florian Schleiss
- Reto Augsburger
- Werner Reichen

Mechanical Workshop:

- Peter Schütz
- Urs Hunziker

Materials Analysis:

- Josef Zürcher

Research group: Applied Fiber Technology

The **Applied Fiber Technology Group** runs projects on:

- Design and production of modern **active an passive fibers**
- Conventional and fiber based **beam delivery**
- **Ultrashort fiber lasers** for materials microprocessing
- **Integration of fiber lasers** in modern production processes and machines

In tight collaboration with the IAP of the University of Bern

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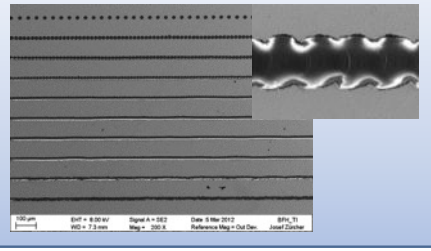
Process and machine integration

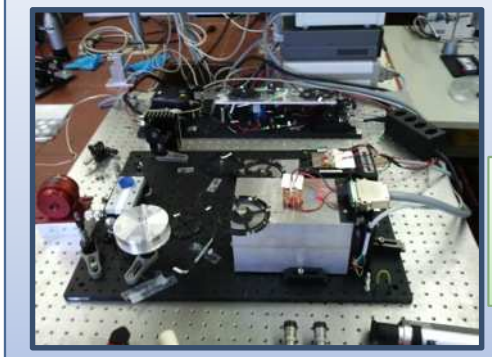
Example: *CTI project*
CIGS: Ultraprecise machining of photovoltaic thin films with fiber lasers and fiber delivery

1



Parameter study of laser-ablation of photovoltaic thin films

2



Fiber laser, fiber: design and experimental set up.

3

Packaging, system integration

Research group: Laser Surface Engineering

- **Pulsed Laser Processing**

  Laser Micro – processing and surface structuring
  - Focus on ultrashort laser pulses (ps)
  - Process development and basic investigations for process optimization
  - Laser-Material interaction studies
  - Automation an Control (together with ifms)
  - Laser induced Processes (LIPAA, LIBWE, LCLD)

- **Infrastructure**

  Fully equipped “dust free” optical laboratory
  - DUETTO & FUEGO ps-Systems (10 ps, 1064nm/532nm/355nm wavelength)
  - IPG ns NIR Fiber Laser ($\Delta\tau$ = 4, 8, 14, 20, 30, 50, 100, 200 ns; P_{av} = 20W)
  - IPG ns Green Fiber Laser ($\Delta\tau$ =1.5ns, P_{av} = 5W)
  - Coherent Verdi V6
  - Coherent Diamond E150 CO_2 – Laser
  - Spectra Physics Quanta Ray
  - Scanner Systems for 1064nm, 532nm and 355nm, New Intelliscan 14 from Scanlab

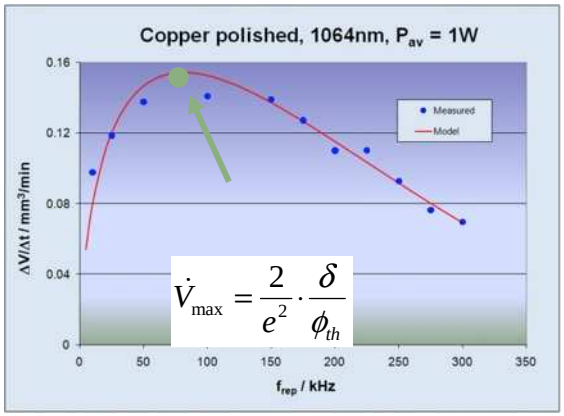
Research group: Laser Surface Engineering

Laser Microprocessing with ultrashort pulses: Process optimization

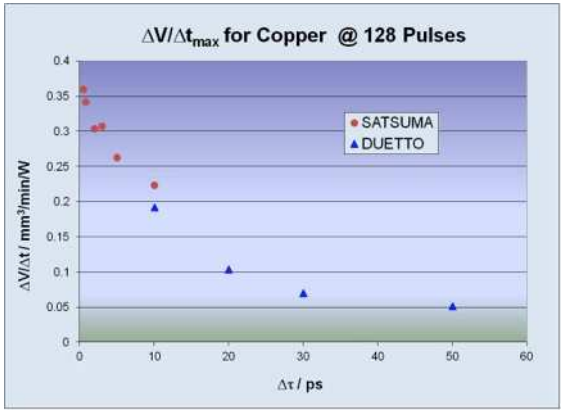
Process optimization has to be done simultaneously in three directions:

Efficiency

Maximize process efficiency



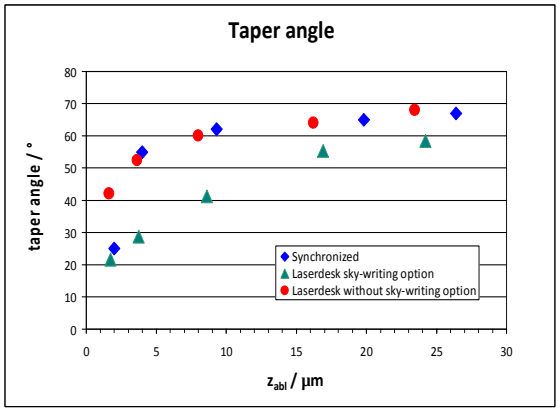
and use best suited pulse duration



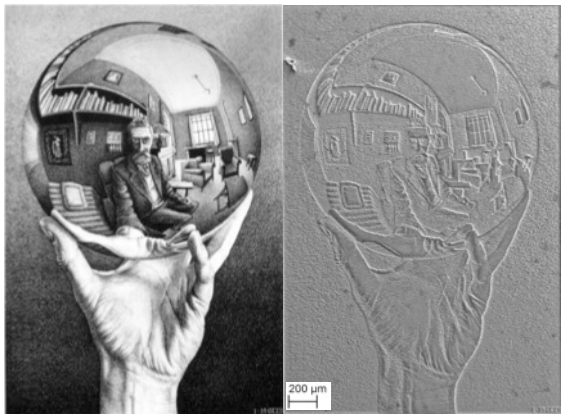
CTI 11196.1 and CTI 11257.2

Strategy

Optimize the structuring strategy



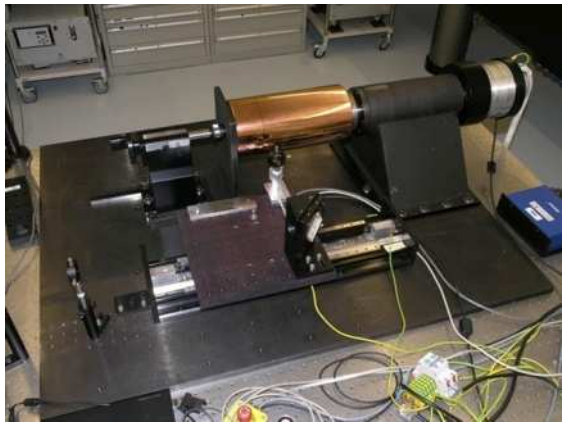
and synchronize axes with the laser



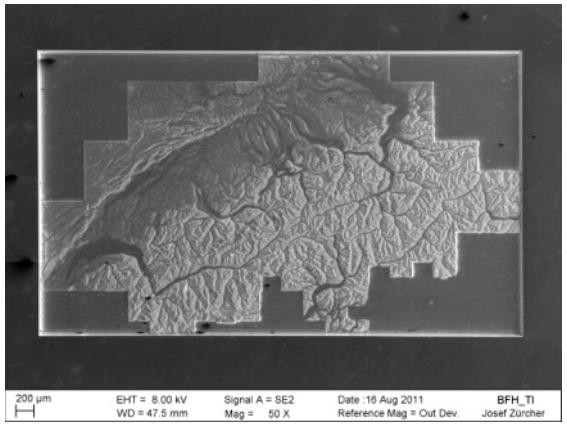
CTI 11257.2

Throughput

Use fast moving axes



to obtain high throughput



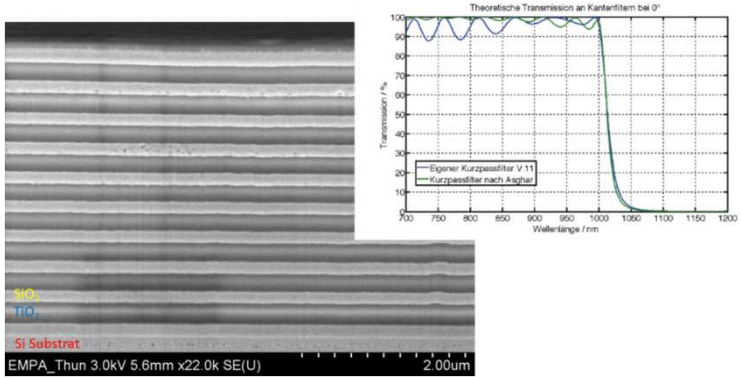
CTI 11257.2

Research group: Thin Films & Surfaces

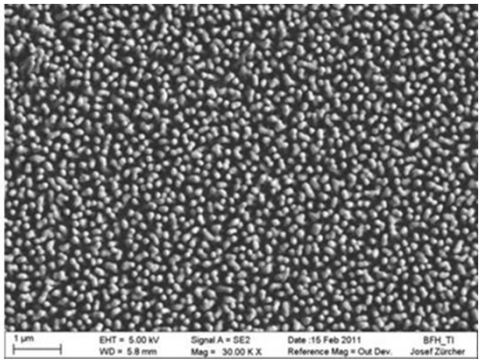
Cleanroom (ISO 6) for thin film deposition & microstructuring (Lithography & Etching)

Applications:

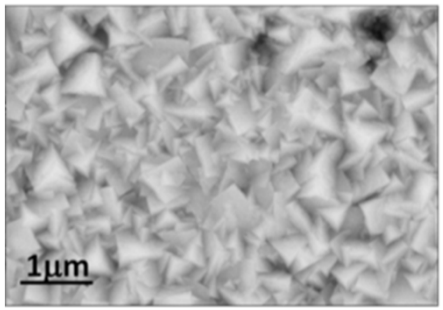
- Optics (dielectric coatings, metallic UV mirrors)
- Electrical conductors for biomedical sensors (Fractal electrodes)
- Laser-induced depostition



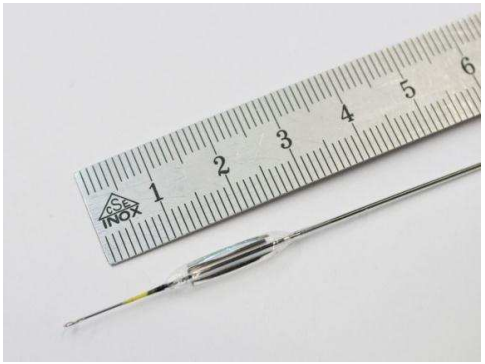
Dielectrical multilayer coating



Ag on O_2-Plasma treated PET

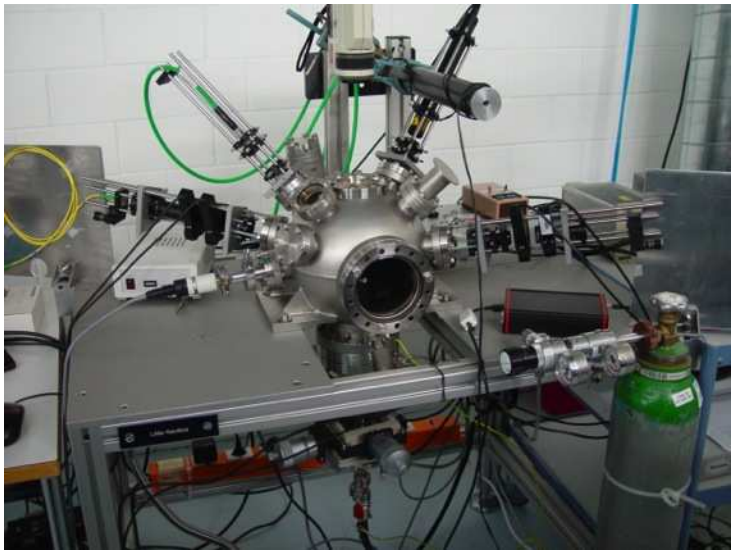


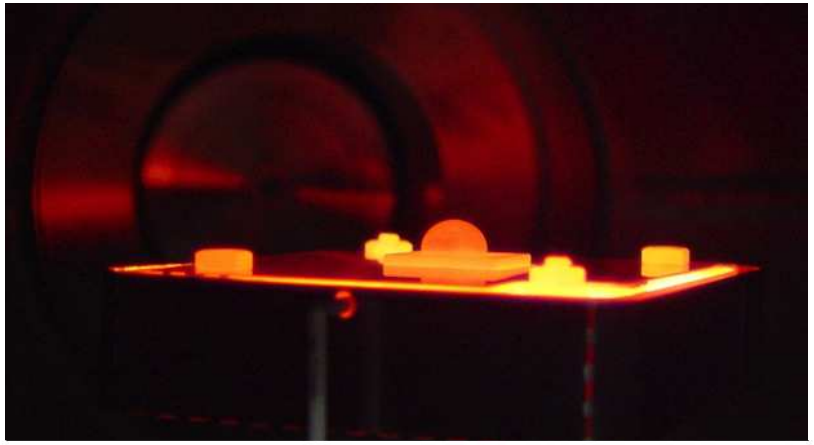
Laser-induced chemical liquid phase deposition of Cu



Electrodes on Balloon-Catheter

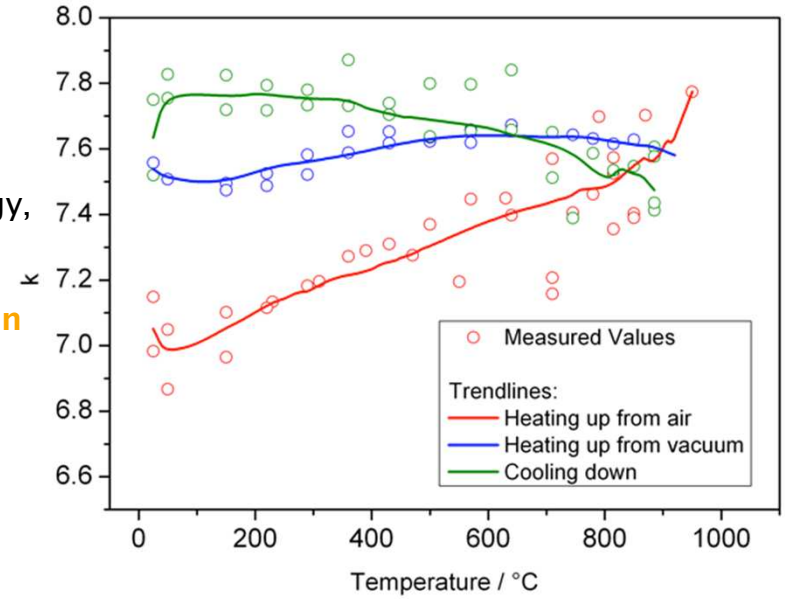
Ellipsometry of Metals and Alloys: From room temperature up to the liquid phase (Research Groups Laser Surface Engineering and Thin Films & Surfaces)





Nicely combines the competencies of ALPS:
Laser, optical measurement techniques, vacuum technology, materials, surface physics,…

Yields the temperature dependence of refractive index n And absorption coefficient k
(Example on the right: Ag coating on Si wafer



Supported by CTI