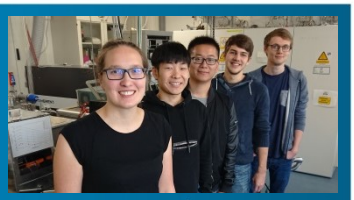
Masterarbeit in der Nachwuchsgruppe Hoffmann-Urlaub



Laser–induced periodic surface structures (LIPSS)

When a target is irradiated by ns laser pulses, a rapid heating material takes place, followed by a fast cooling down of the affected volume. During the heating and cooling, laser-induced periodic surface structures (LIPSS) are formed, due to interference between the incoming and the surface scattered wave. Hence wave-like or rippled structures occur (see Fig. 1), whose period L is given by the index of refraction n, the angle of incidence θ and the laser wavelength λ

$$L = \lambda/(n - \sin\theta)$$

For various polymers (e.g. Poly (trimethylene-terephthalate) (PTT)) this effect is documented and investigated by surface sensitive techniques such as Atomic Force Microscopy (AFM). The morphological change of the surface can be controlled by varying the energy and number of pulses (see Fig. 2).

The aim of this thesis is to find out **how precisely the structural changes can be tuned and what are the limitations and important parameters?**

Additional to structural changes of the surface also the **chemical structure** of the polymer chains is affected. This can be investigated by using Fourier-transform infrared spectroscopy (FTIR) (see Fig. 3).

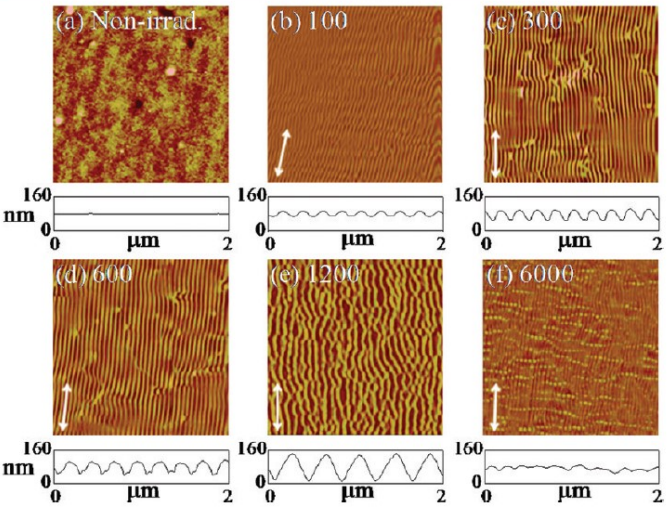


Figure 1 dx.doi.org/10.1021/la300833x

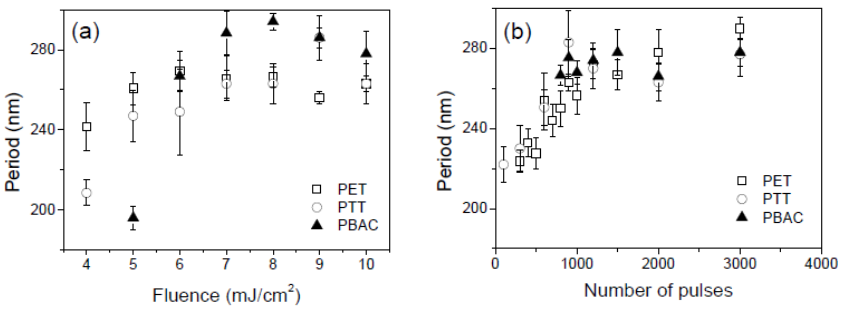


Figure 2 doi.org/10.1016/j.eurpolymj.2015.10.012

Furthermore, a task is to **extend the range the materials** to semiconductors, oxides or metals.

Methods: Pulsed Laser Deposition, AFM, SEM, XRD, FTIR, UV-VIS absorption

Methodology – variation of:

- Baking time and temperature, crystallinity dx.doi.org/10.1021/la200451c
- Polarization
- Energy/density, Repetition rate, number of pulses
- Angle of incidence doi: 10.1007/s00339-011-6472-3
- Materials:

  InP, GaAs, GaP and SiC
  dx.doi.org/10.1016/j.apsusc.2012.11.137
  Ge, Si, Al, and brass
  doi.org/10.1103/PhysRevB.27.1155
  Cu, steel doi: 10.1016/j.phpro.2013.03.150

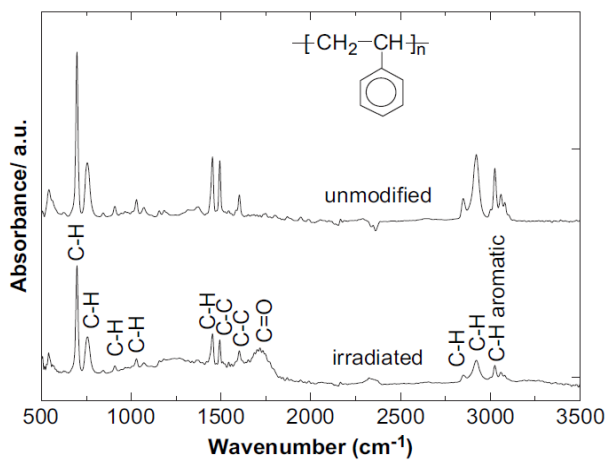


Figure 3 doi.org/10.1016/j.biomaterials.2007.12.039

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