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Introduction

• **Conducting polymers** are nowadays a source of numerous and diverse lines of investigation. These polymers are encouraged by -among others- the possibility of fabricating nanostructures that, through influencing over its electrical or optical properties, may lead to an improvement in organic electronic devices.

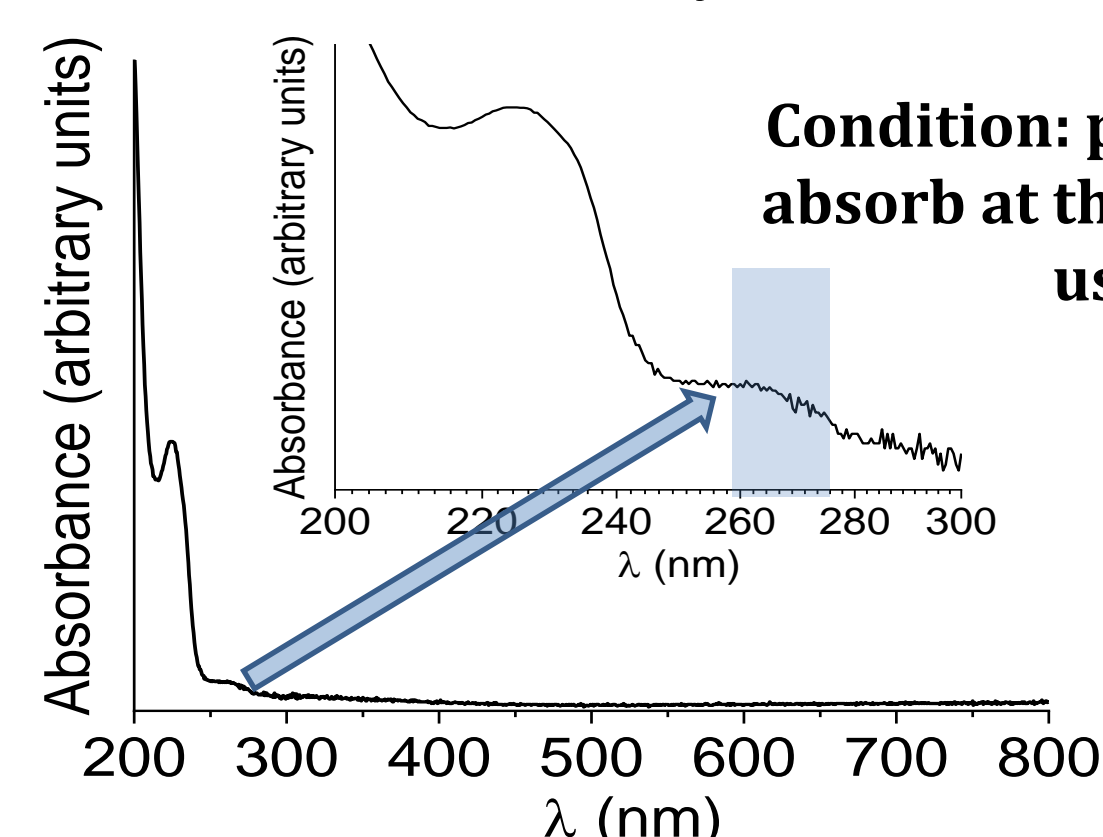
• Poly(3,4-ethylenedioxythiophene):Polystyrene sulfonate (**PEDOT:PSS**) is one of the most successful conductive polymers, commercially available in a water colloid [1].

• Among nanostructuring approaches, **pulsed laser irradiation** is a rapid, effective and reproducible approach to fabricate grating-like patterns on the material surface [2].

LIPSS: nanostructures by laser

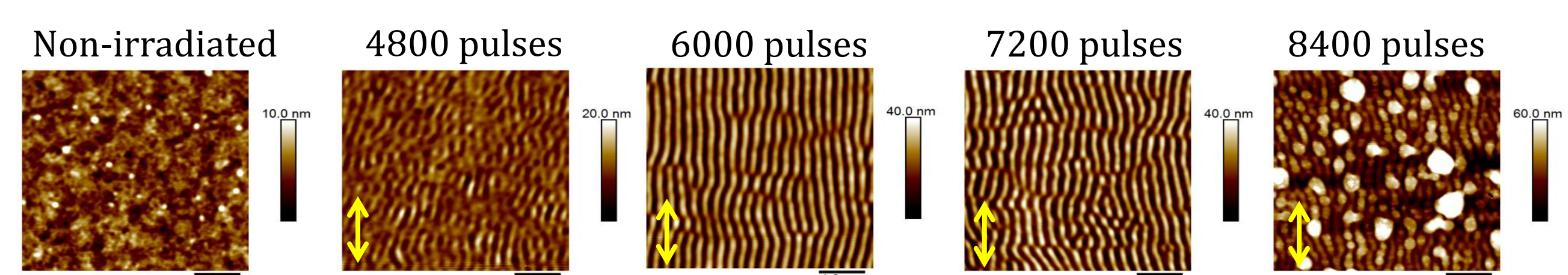
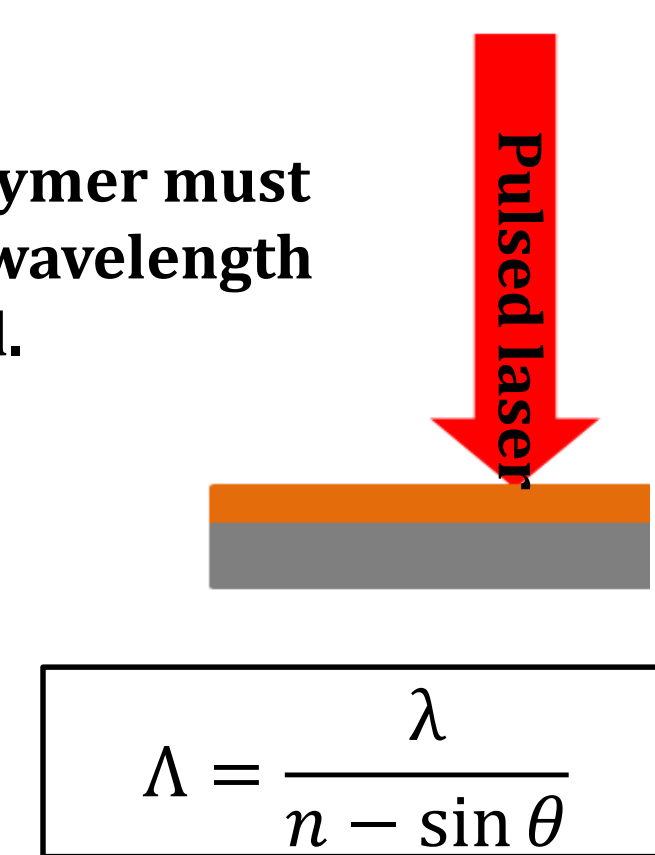
LIPSS = Laser Induced Periodic Surface Structures [2]

PEDOT:PSS UV-VIS analysis

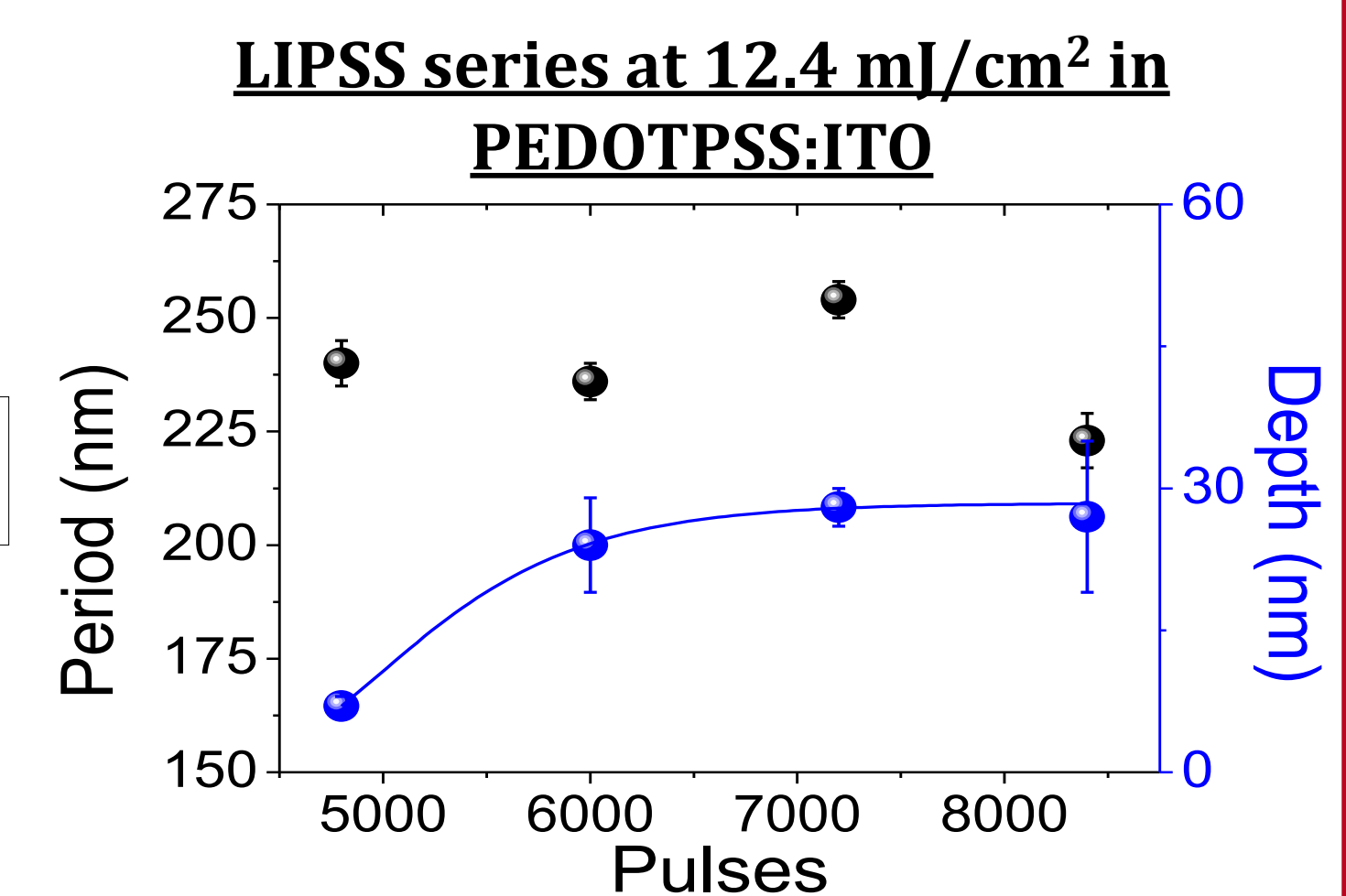
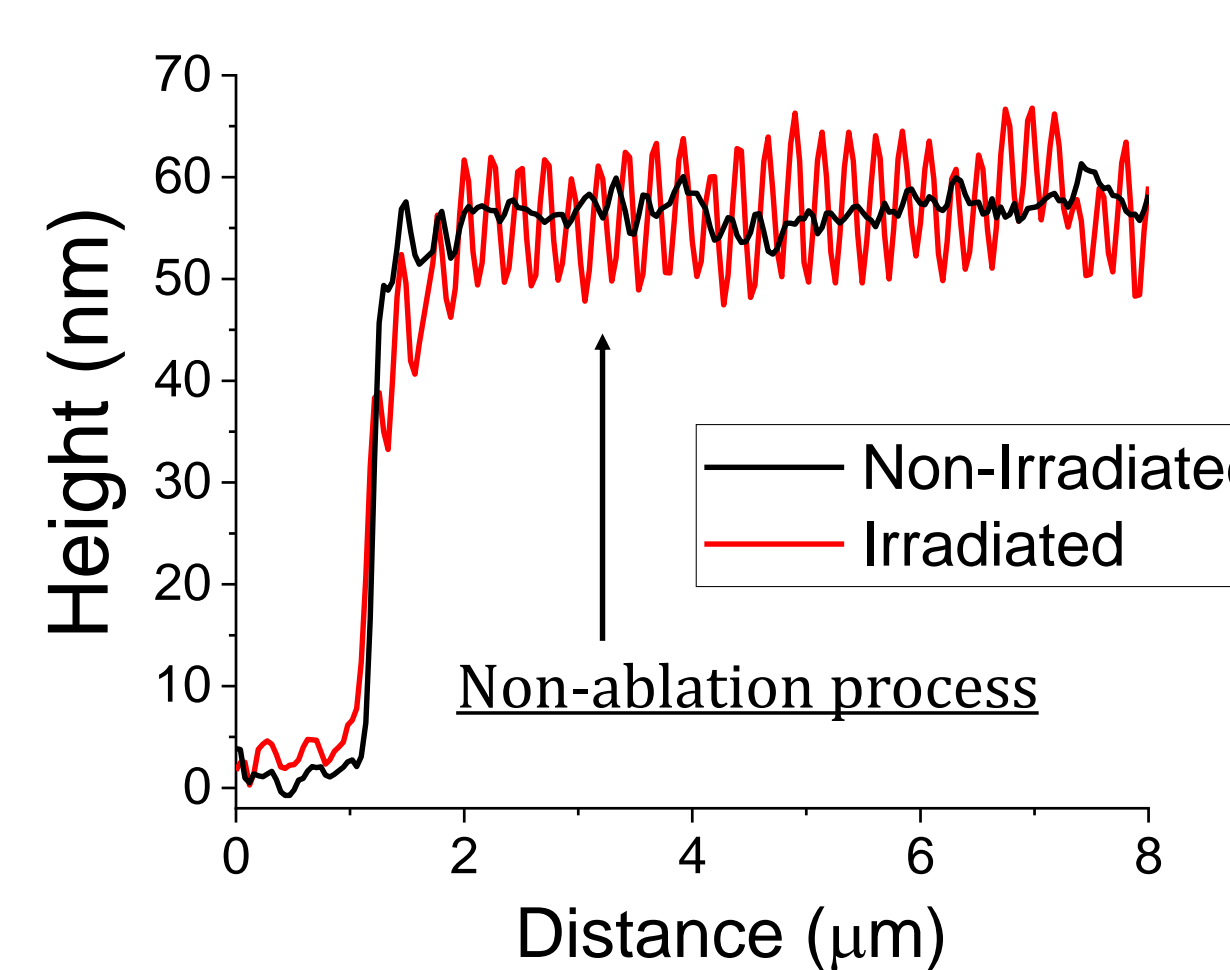


Condition: polymer must absorb at the wavelength used.

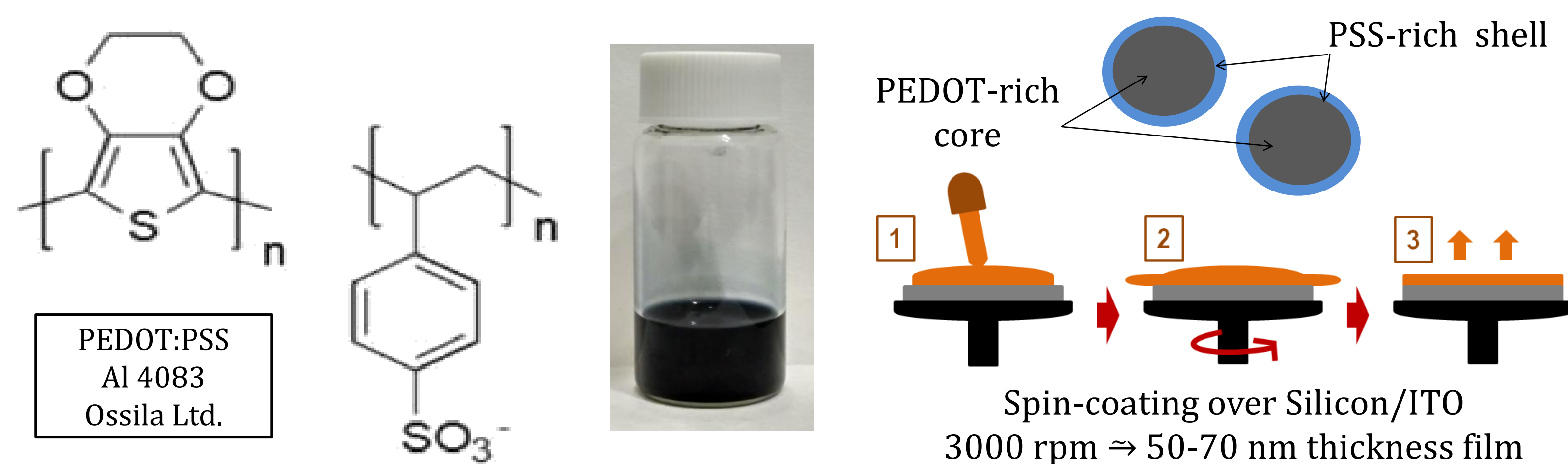
Nd:YAG
4th harmonic
 $\lambda = 266 \text{ nm}$
Pulses of 8 ns



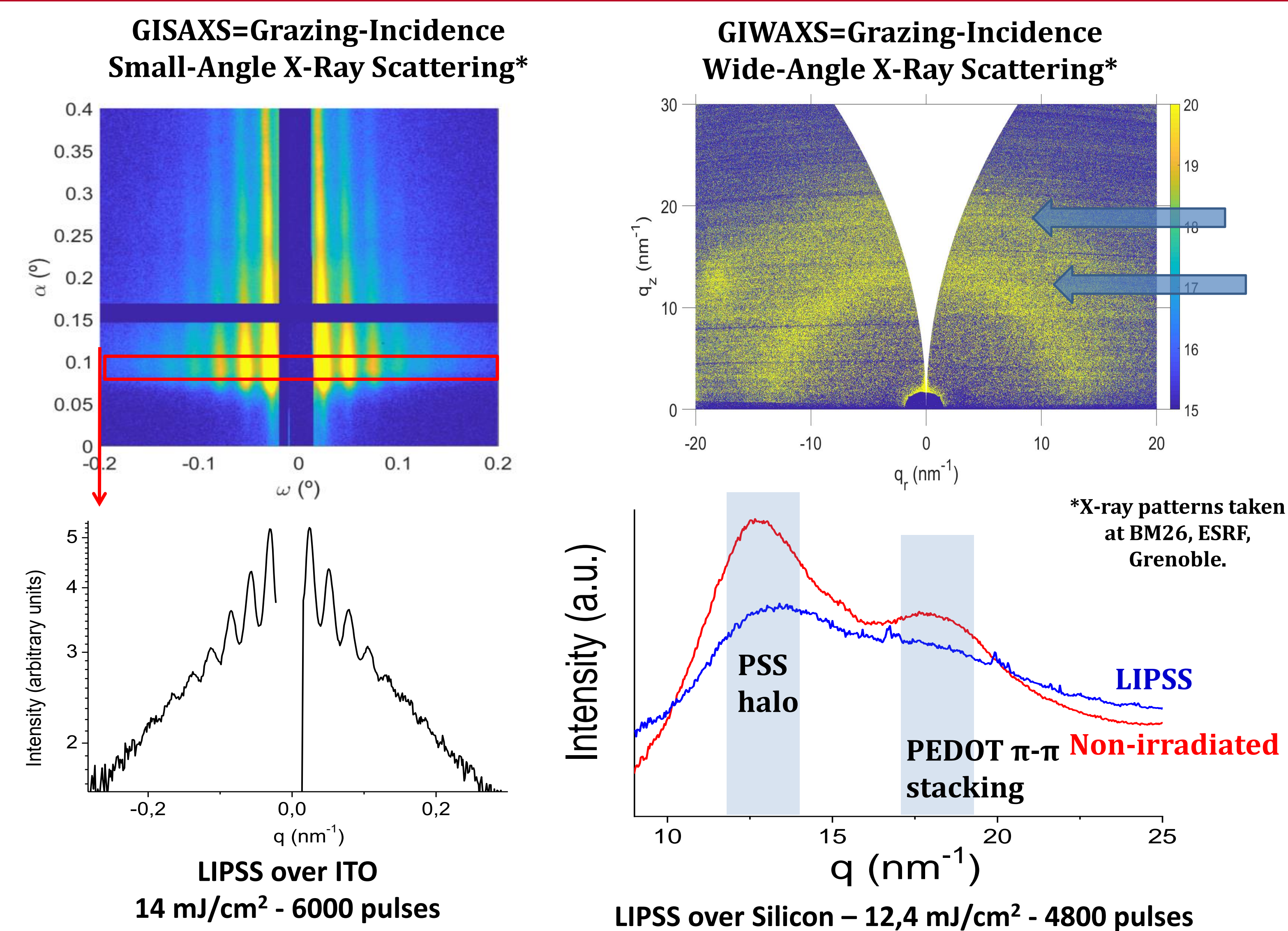
• Formation depends on material absorption, thickness, substrate...
• LIPSS parallel to laser polarization.



PEDOT:PSS, an excellent conductive polymer



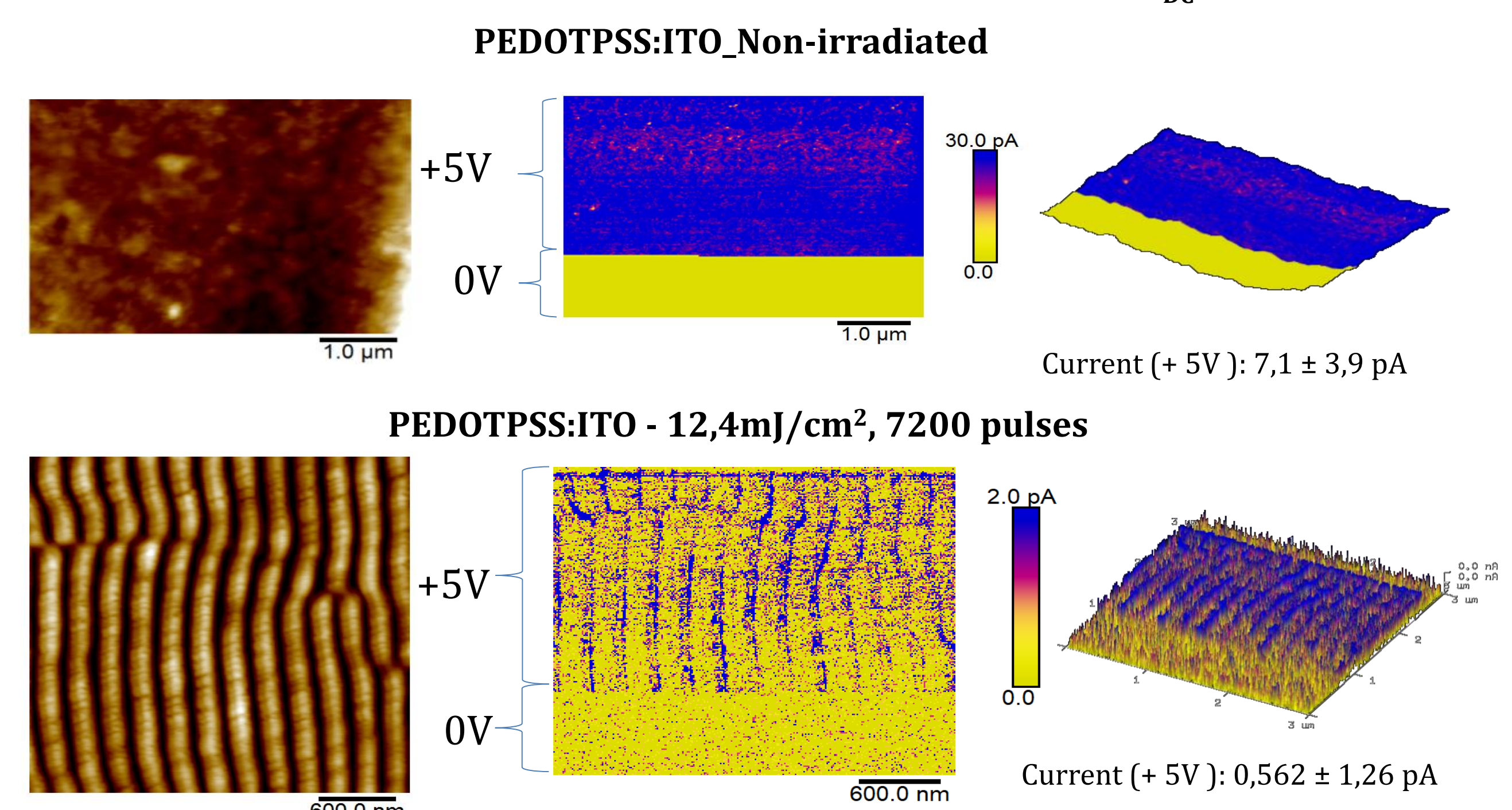
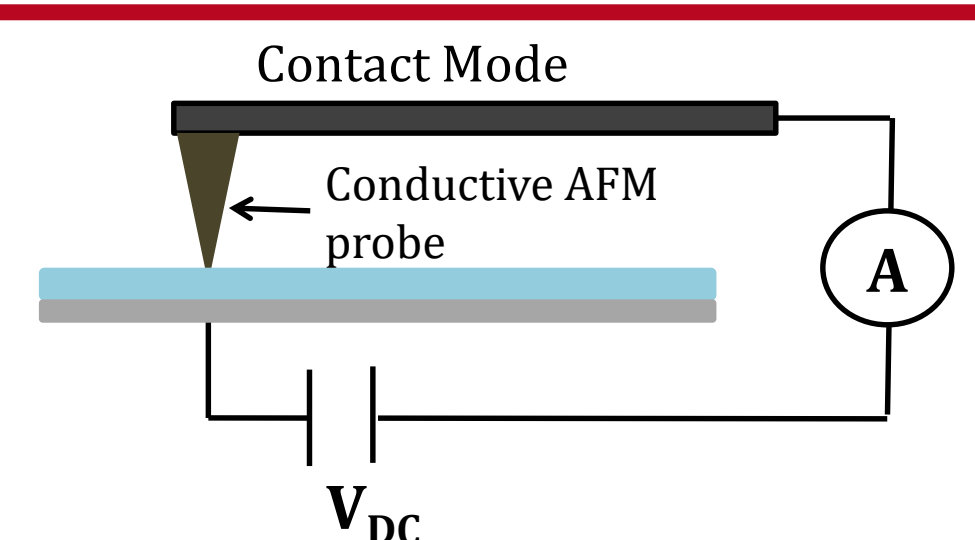
GIWAXS/GISAXS, morphology characterization



• GISAXS gives us quantitative information about the order of the LIPSS over a large area. This is a more accurate way to calculate optimum irradiation conditions than AFM characterization.
• GIWAXS gives us information about the crystallinity degree and orientation induced by the laser irradiation. The intensity decrease of PEDOT π - π stacking peak [3] indicates a lower crystallinity degree possibly caused by the fast heating-cooling during irradiation process.

C-AFM: electric current

• **Conductive mode of the AFM:** measures the electric current that passes through the sample after applying a voltage difference between the tip (probe) and the conductive substrate.



• PEDOT:PSS LIPSS maintain the conductivity through the nanostructures despite a relative decrease in the average values of electric current, possibly due to the decrease of crystallinity degree previously mentioned.

Conclusions

- PEDOT:PSS thin films are transparent for visible radiation. In the UV spectrum, a window of absorption around 250 nm allows to induce grating-like nanostructures over conducting PEDOT:PSS thin films by irradiating with a nanosecond pulsed laser at the fourth harmonic of a Nd:YAG laser: 266 nm.
- LIPSS with a period close to the laser wavelength and 20-50 nm depth are achieved.
- GIWAXS results indicate a loss of crystallinity possibly produced by the fast heating cooling treatment after laser irradiation.
- Electrical conductivity through the pattern of the sample is maintained after nanostructuring, though it decreases.

References

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