

Karakterizacija nanostruktura: električna, optička i strukturna

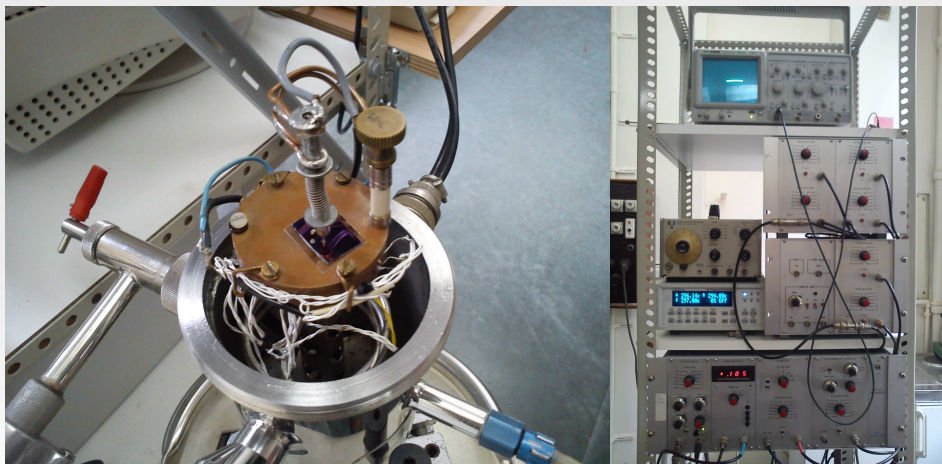
Električna karakterizacija

- Osnovna: Strujno-naponska (I-V) i kapacitivno-naponska (C-V) mjerenja; Ovisnost o temperaturi;
- Tranzijentna spektroskopija dubokih nivoa (DLTS)
- Priprema uzoraka sa nanostrukturama za električna mjerenja (diode, MOS strukture)

Električna karakterizacija

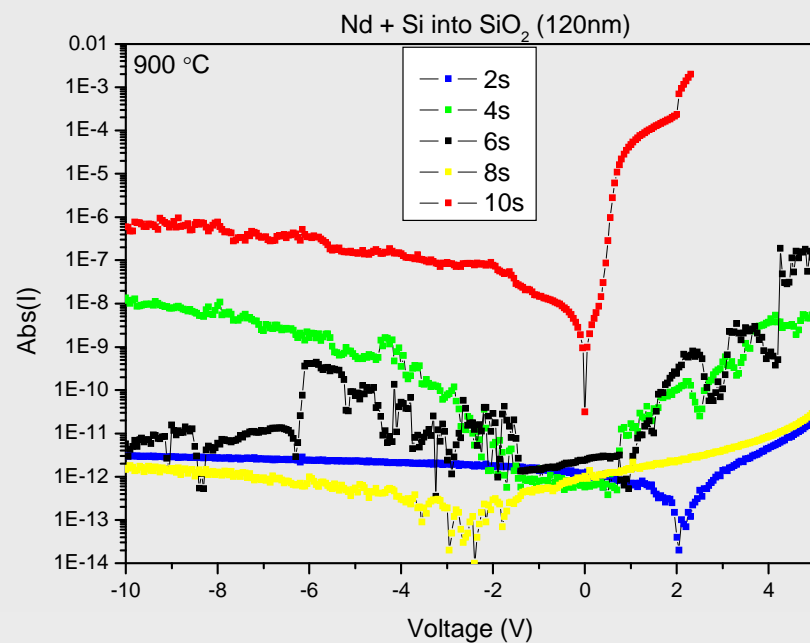


I-V

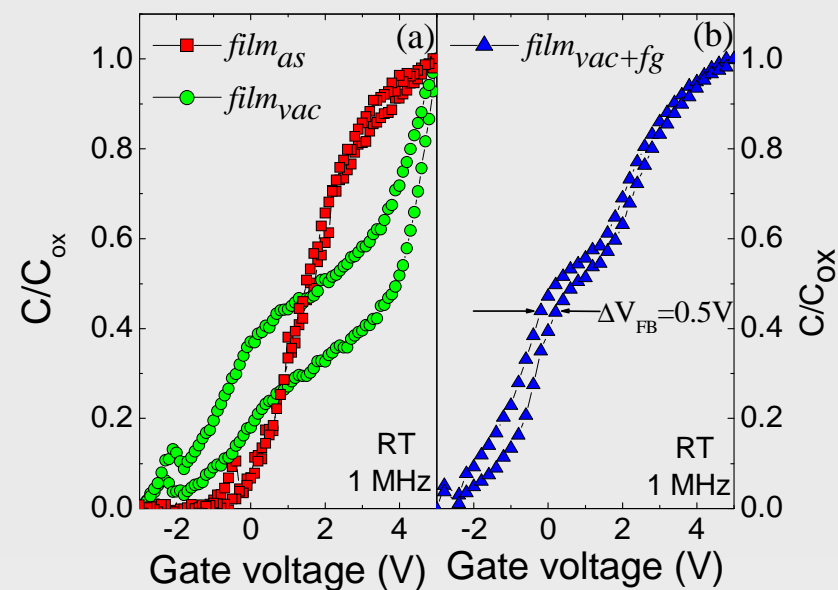


C-V, DLTS

Električna karakterizacija



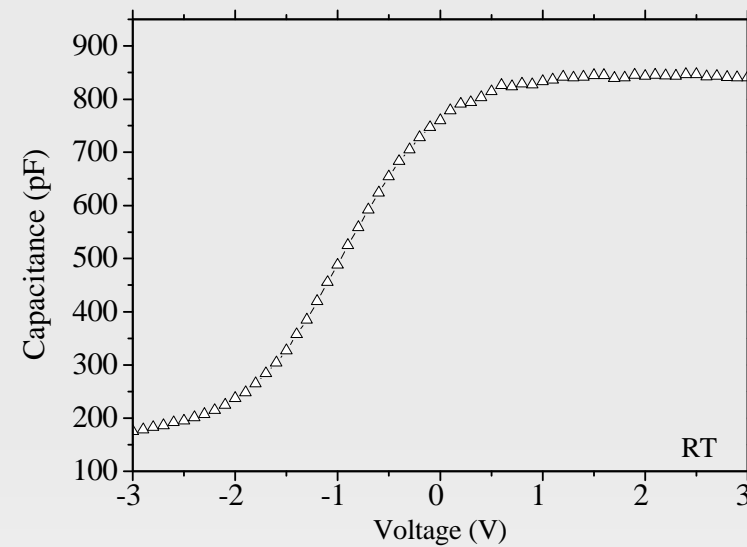
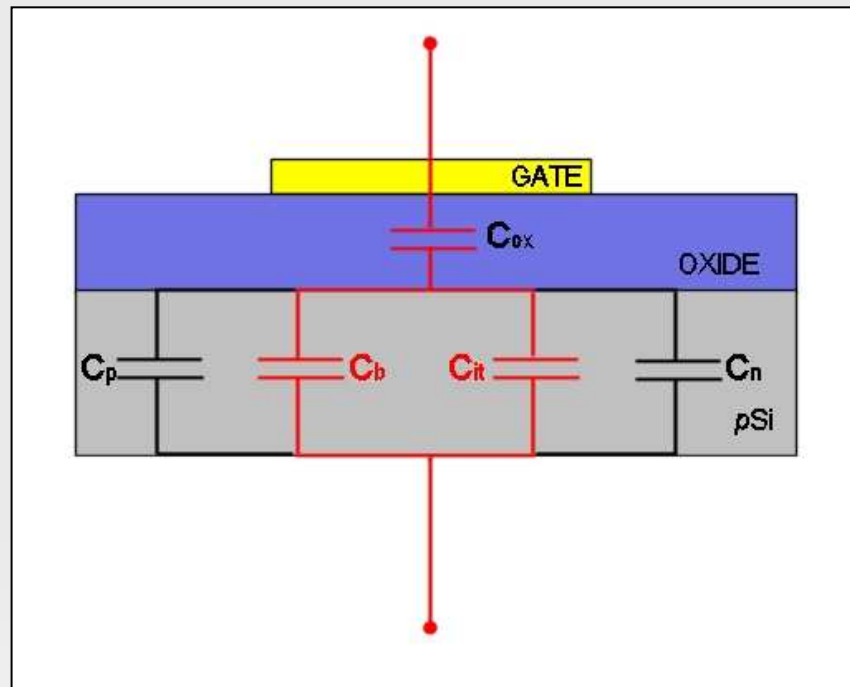
I-V



C-V

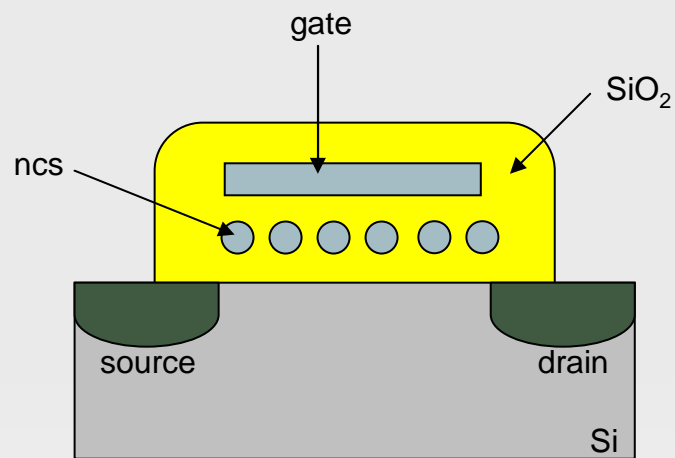
$$\Delta V_{FB} = \frac{ed_{QD}}{\epsilon_{ox}} \left(t_{ox} + \frac{\epsilon_{ox}}{\epsilon_{Ge}} R_{QD} \right)$$

Električna karakterizacija

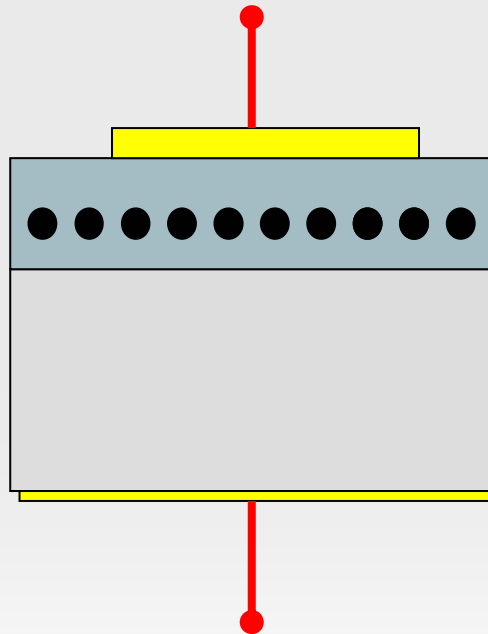


Električna karakterizacija

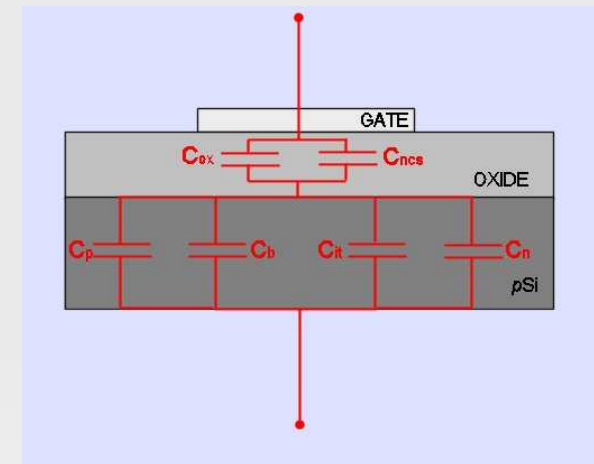
1.



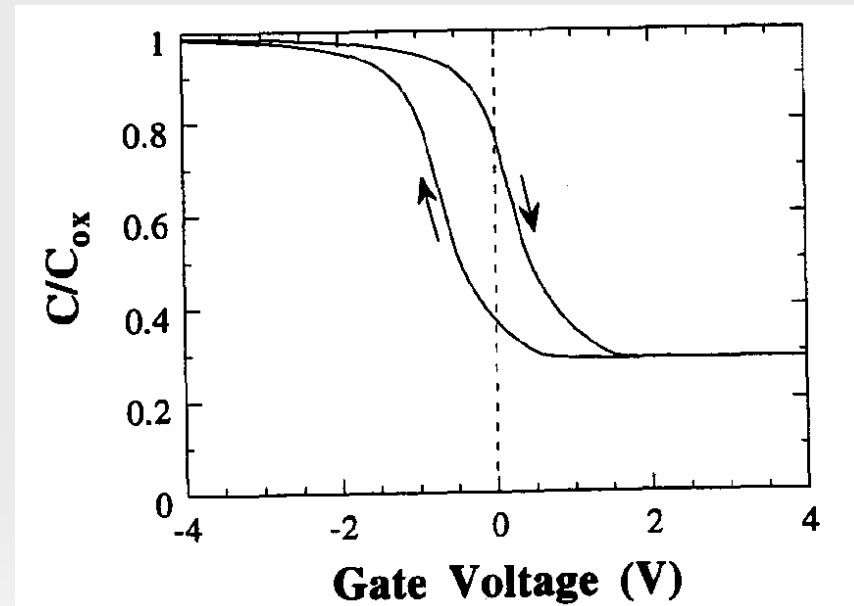
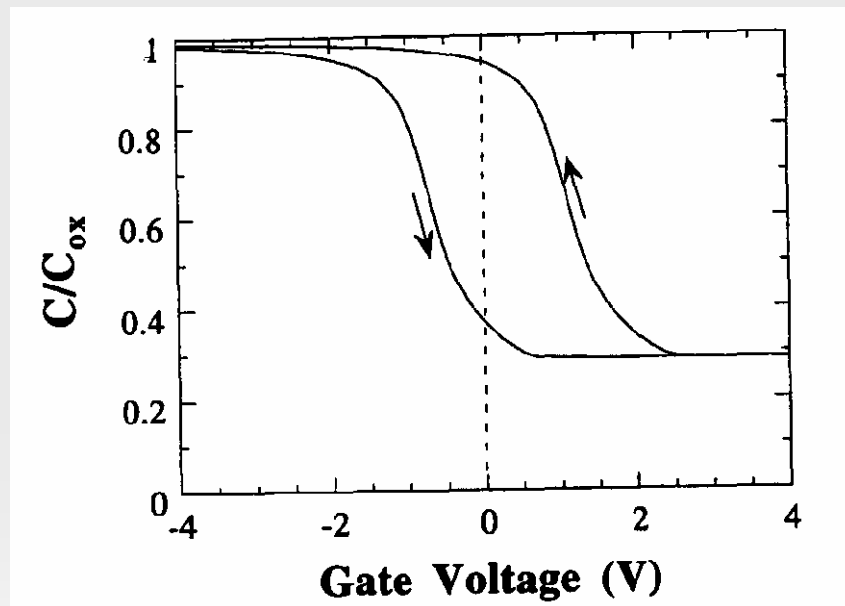
2.



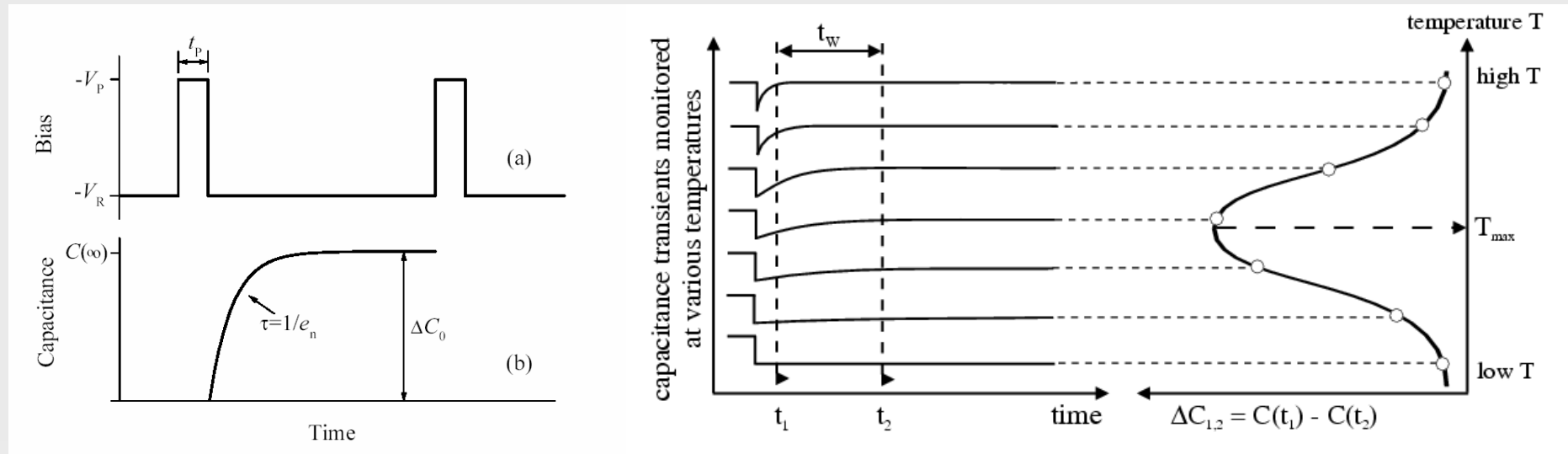
3.



Električna karakterizacija

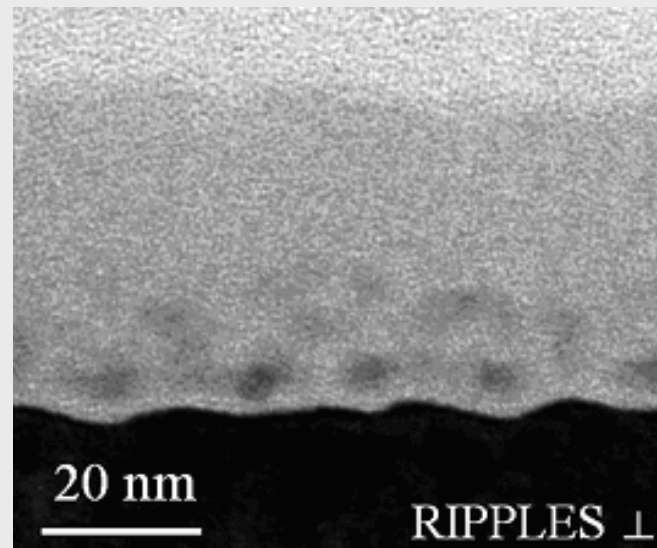
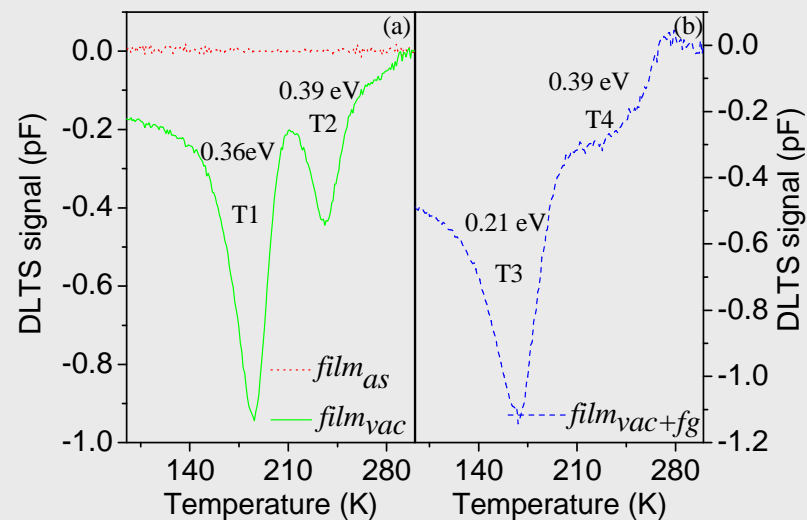


Električna karakterizacija



Tranzijentna spektroskopija dubokih nivoa

Električna karakterizacija

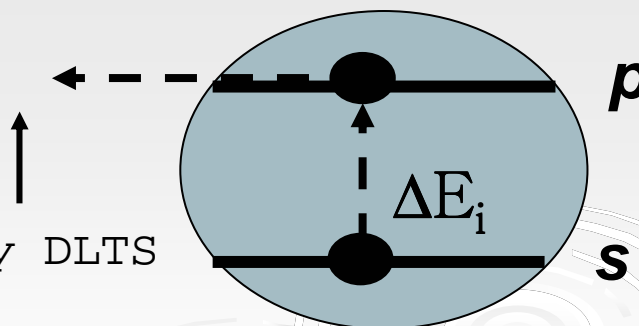


$$e_n = \gamma_n \sigma_n T^2 e^{\frac{\Delta E_a}{kT}}$$

$$\Delta E_i = E_{n=2} - E_{n=1}$$

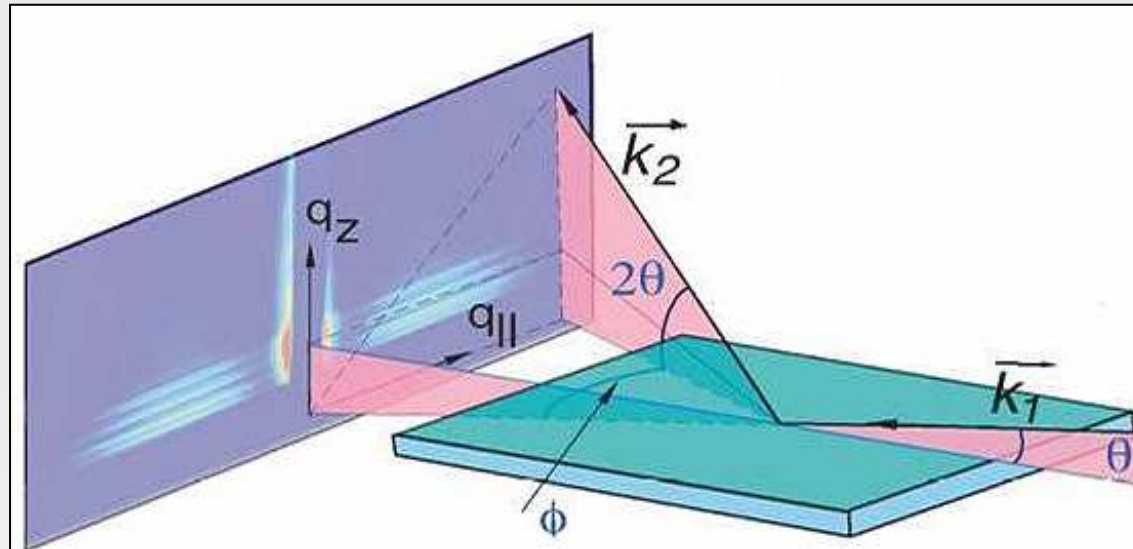
$$E_n = \frac{\hbar^2 n^2 \pi^2}{2m(2R_{QD})^2}$$

Detected by DLTS



Strukturna karakterizacija

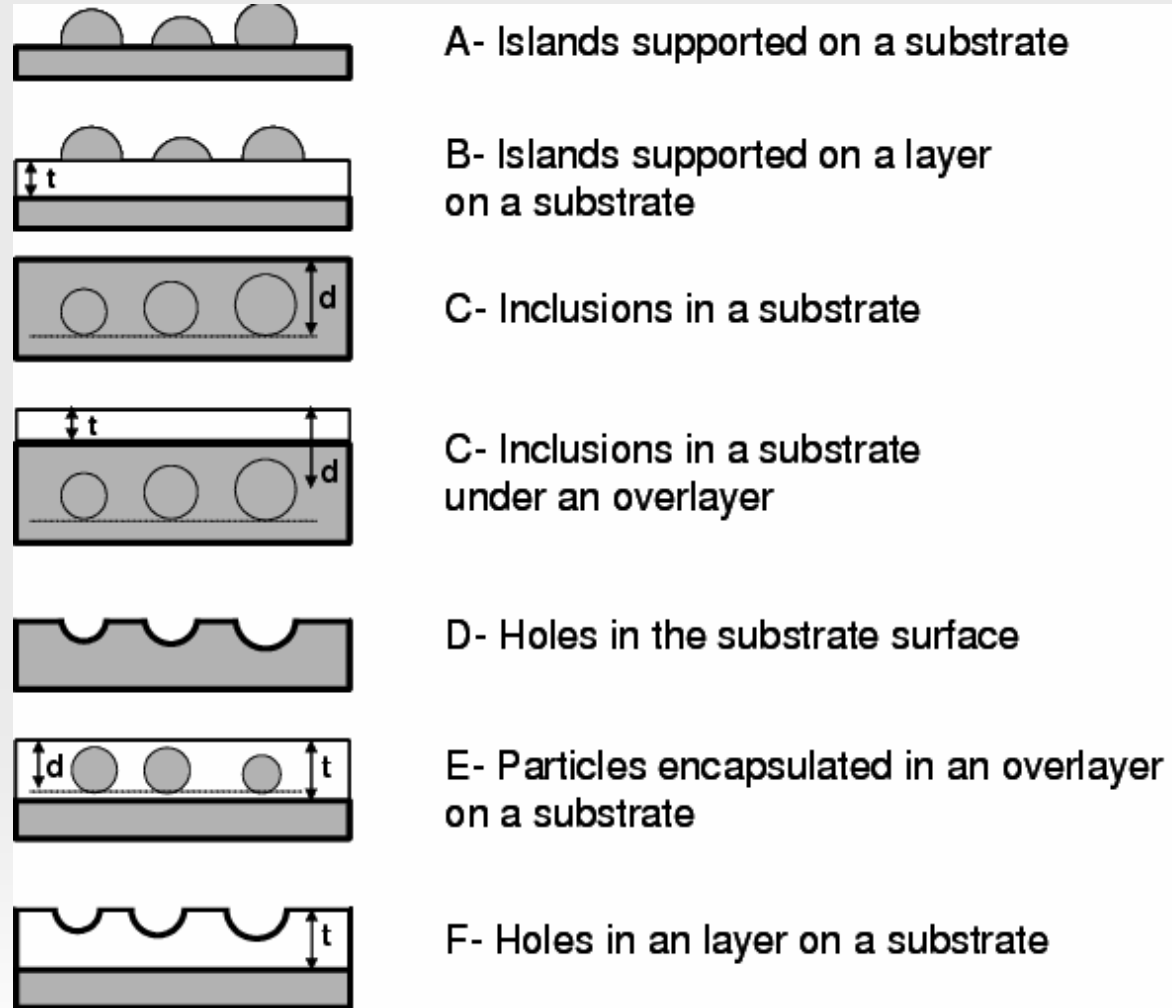
- Osnovna karakterizacija je još uvijek TEM!!!
- STM, AFM ...
- Raspršenje X-zraka (SAXS, GISAXS...)



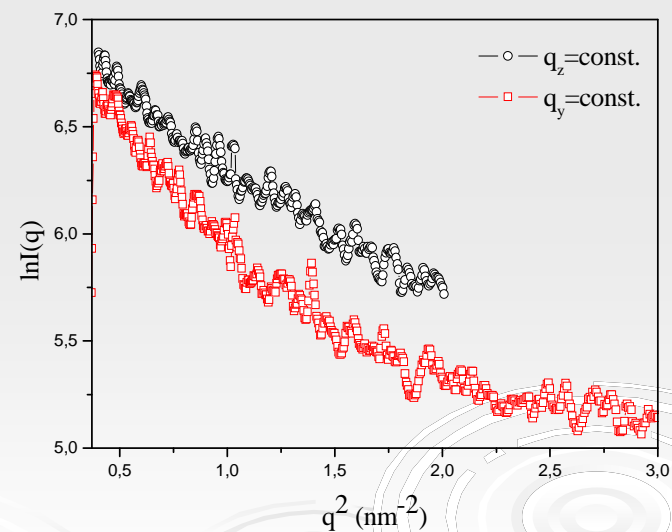
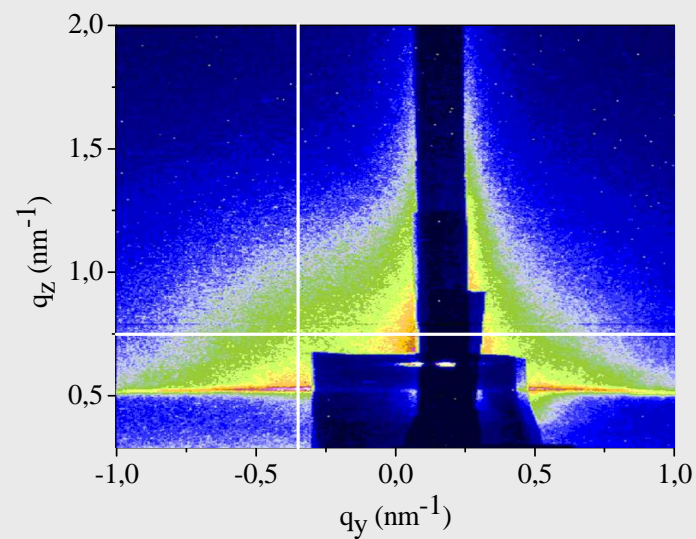
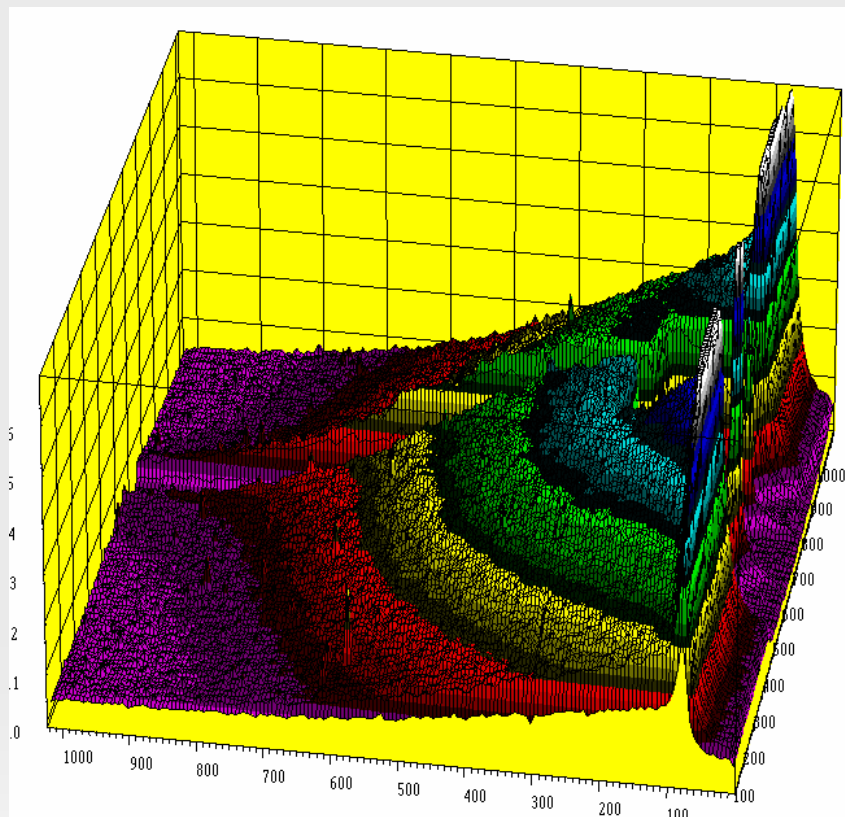
Sinkrotron Elettra, Trst → Small Angle X-ray Scattering
 $\lambda=0.154$ nm ; 8 keV ; 2D CCD 1024x1024; $0.5 < d < 1.5$ m

Strukturna karakterizacija

Što sve vidi
SAXS?



Strukturna karakterizacija



Optička karakterizacija

- Fotoluminiscencija (PL) *is a process in which a substance absorbs photons (electromagnetic radiation) and then re-radiates photons. Quantum mechanically, this can be described as an excitation to a higher energy state and then a return to a lower energy state accompanied by the emission of a photon. This is one of many forms of luminescence (light emission) and is distinguished by photoexcitation (excitation by photons), hence the prefix photo-. The period between absorption and emission is typically extremely short, in the order of 10 nanoseconds.*



Optička karakterizacija

