



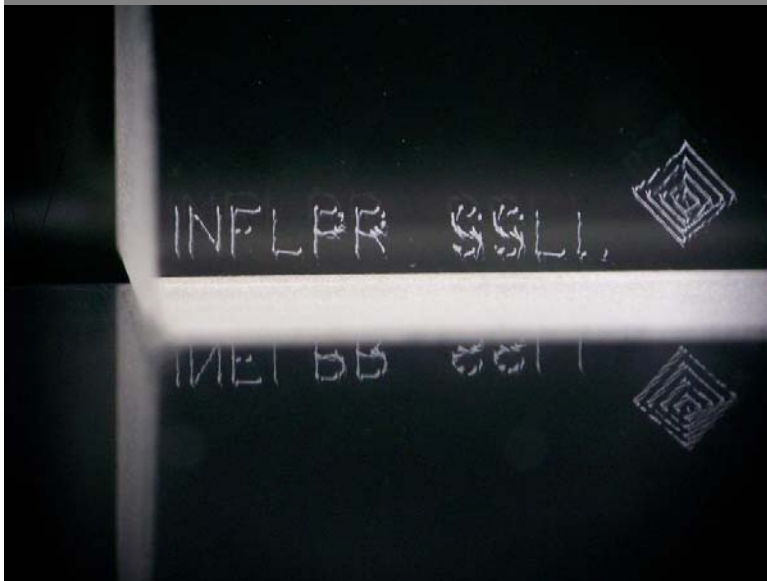
Ablatia filmelor subtiri de tip multistructura Co/Cu/Co cu laseri cu durata de pulsa ultrascurta (fs)

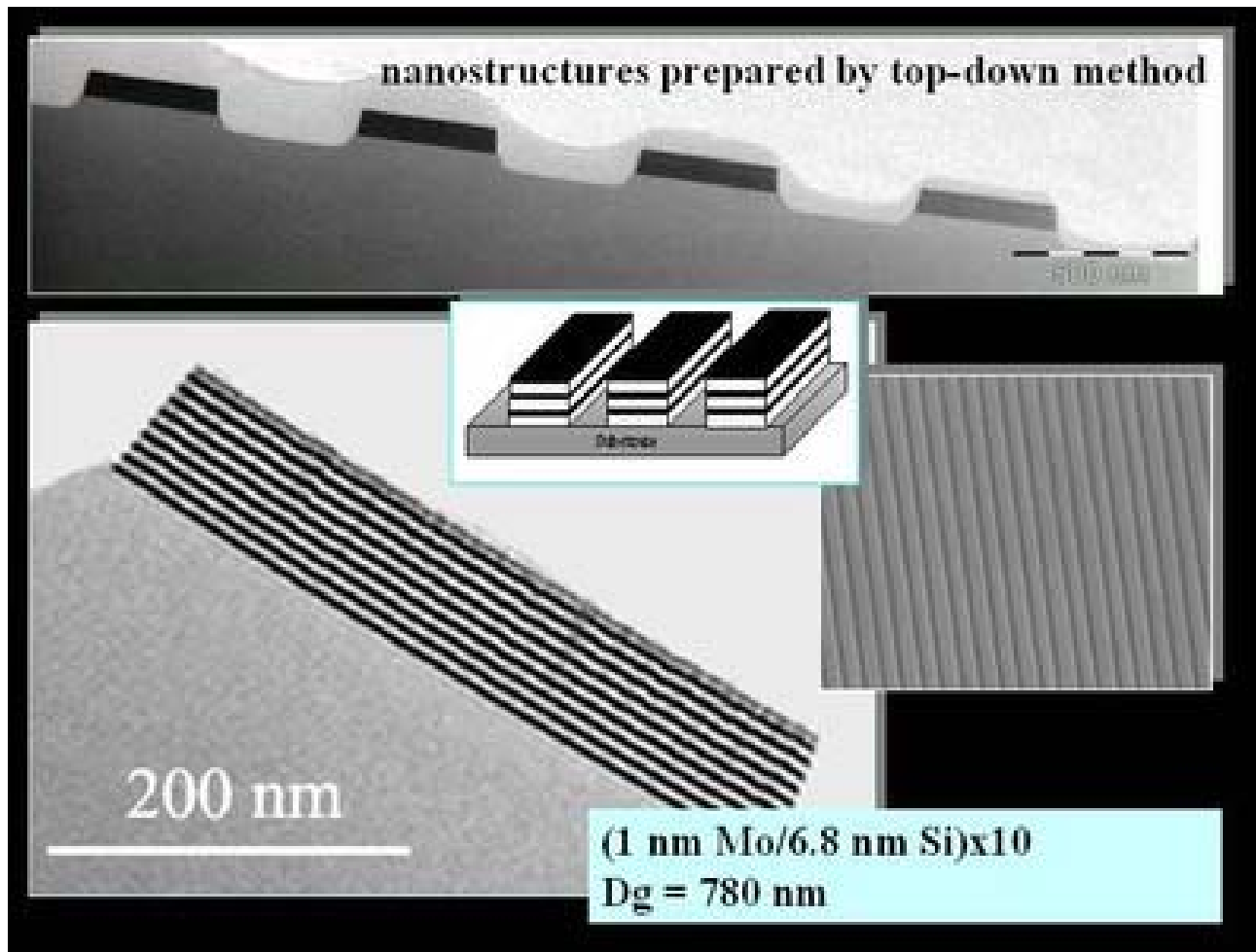
M. Ulmeanu, M. Filipescu, N. Scarisoreanu, L. Rusen, M. Zamfirescu

Magdalena Ulmeanu

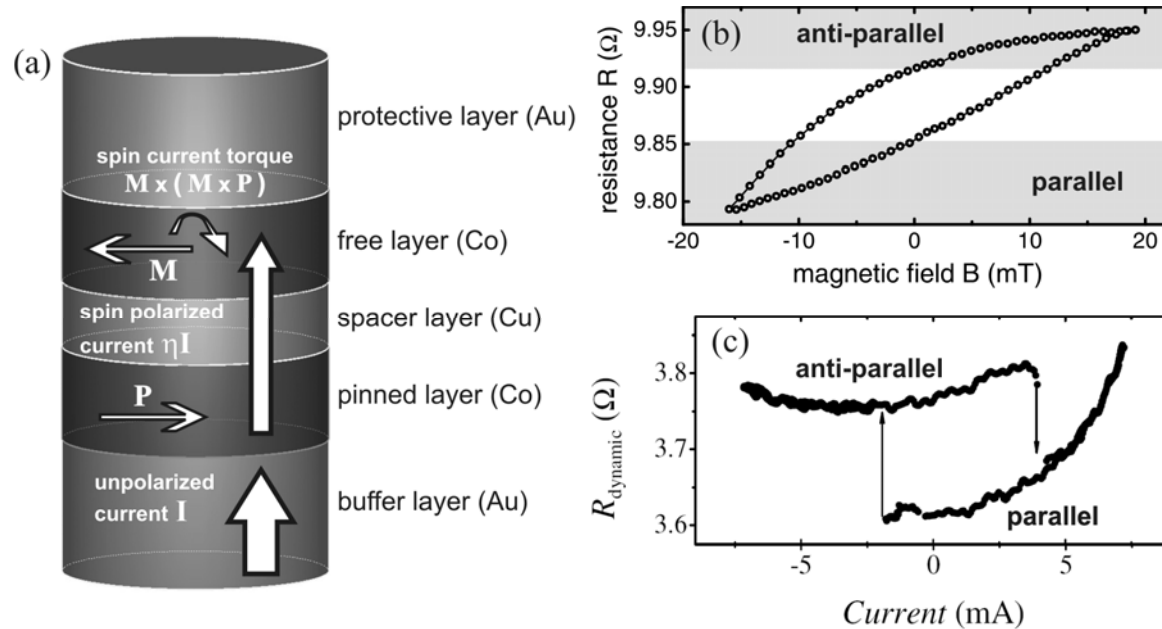
magda.ulmeanu@inflpr.ro

<http://ssl.inflpr.ro>



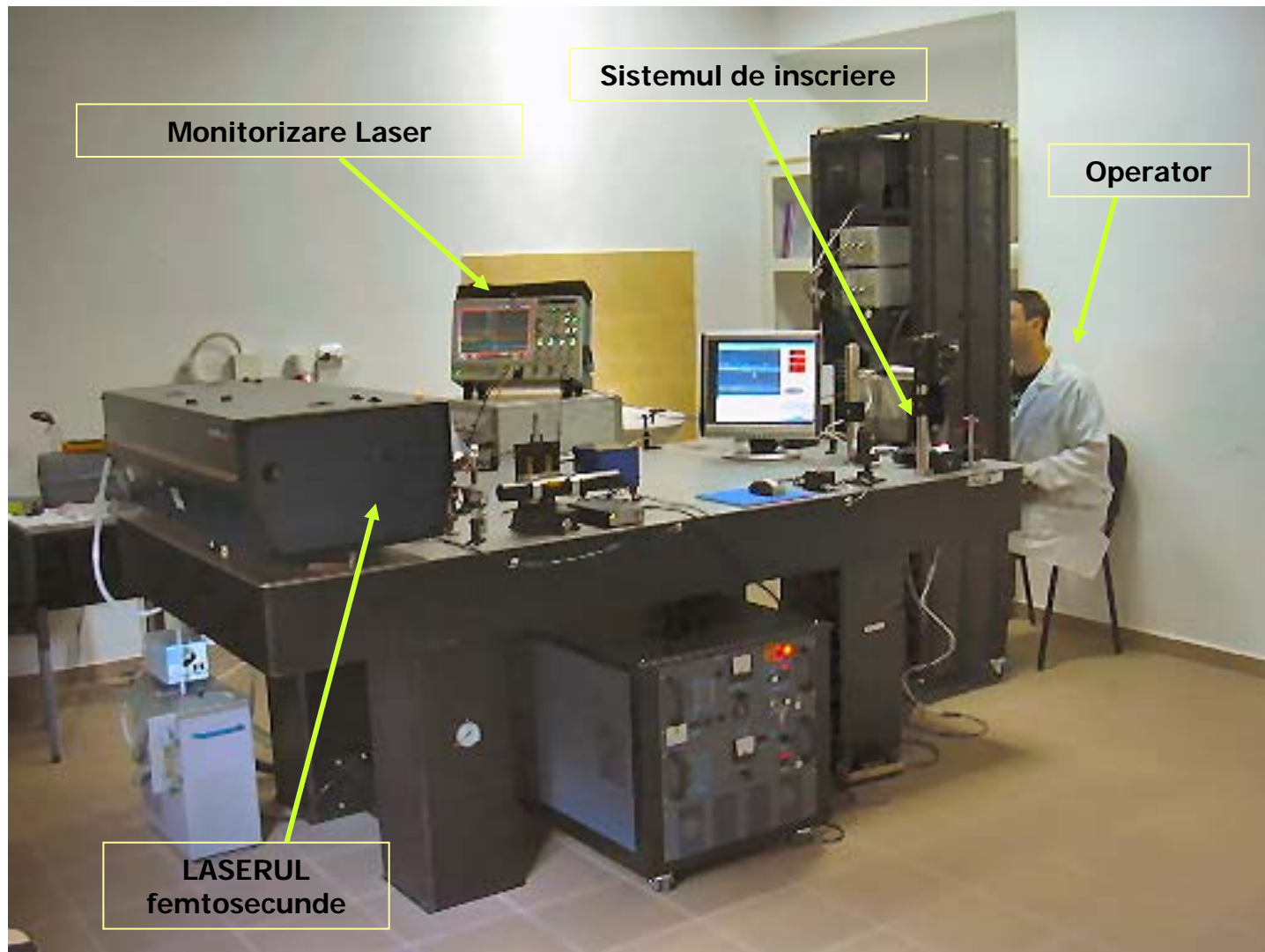


MNT-Eranet "Nanostructuri pentru spintronica si alte aplicatii"
Institutul de fizica al Academiei de Stiinte a Slovaciei

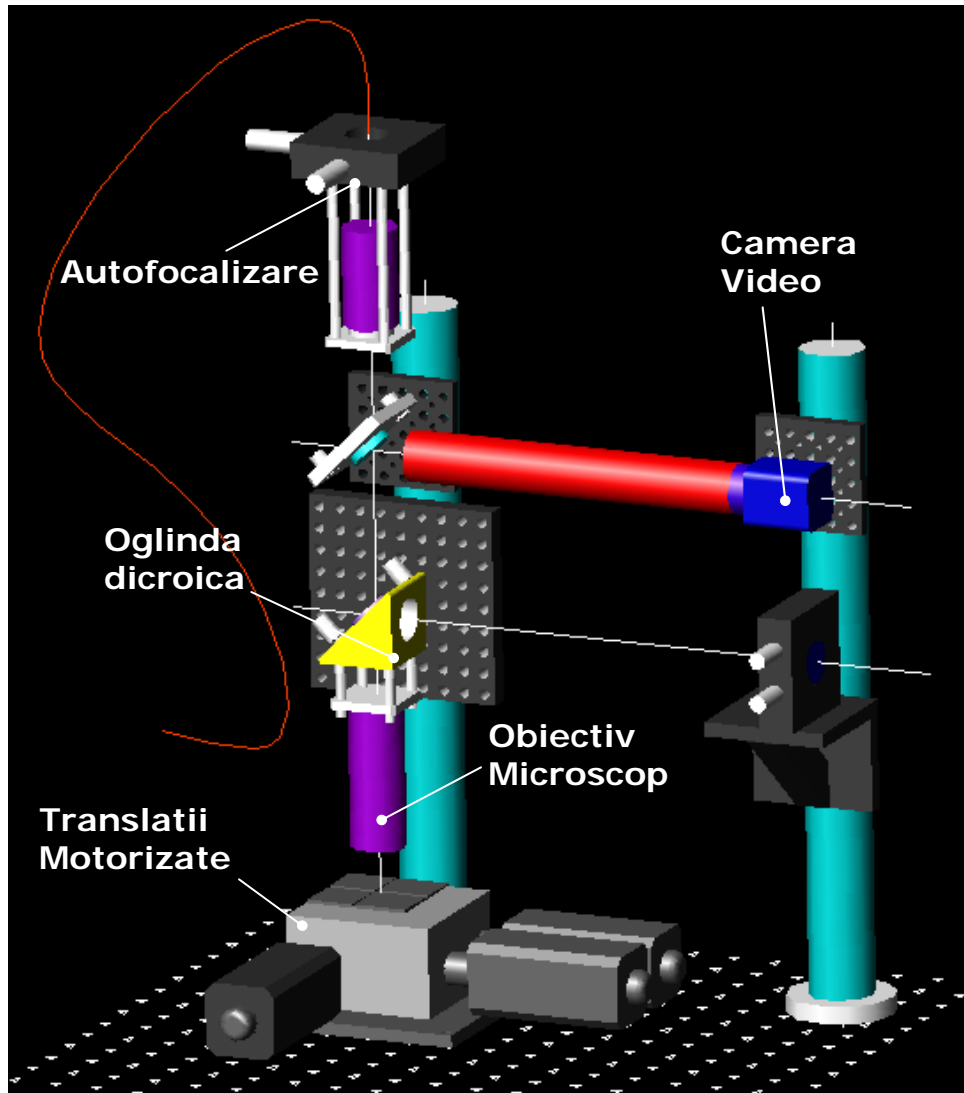


Principiul unei vane de spin GMR realizate de grupul
Institutului de Fizica al Academiei
de Stiinte a Slovaciei

Sistemul experimental de scriere directa cu laserul fs (DLW)



Sistemului opto-mecanic pentru DLW (1)



LASER

- durata de puls 180 fs
- lungimea de unda 775 nm
- frecventa 2 KHz

Obiectiv de microscop

- apertura numerica 0.5NA
- marire 100X
- distanta focala 2 mm

Translatii motorizate XYZ

- gama de deplasare $(4 \text{ mm})^3$
- pas 100 nm
- precizie 400 nm

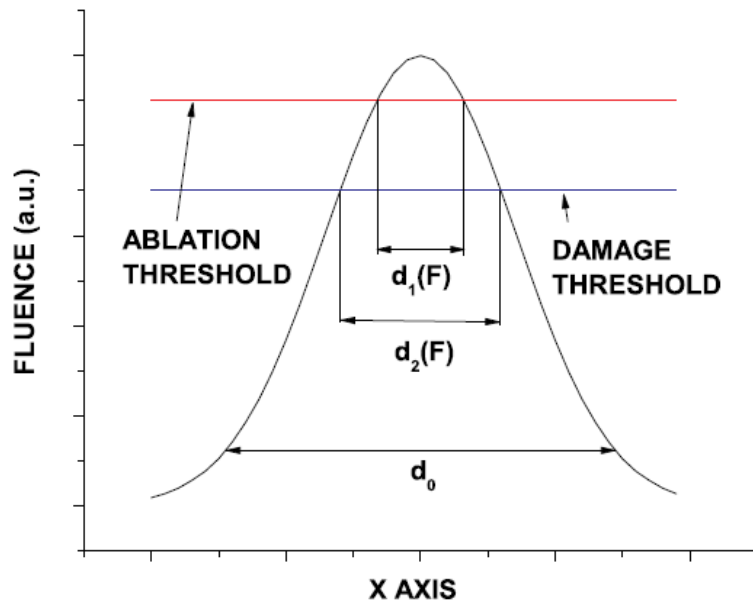
Translatii Piezo XYZ

- gama de deplasare $(20 \mu\text{m})^3$
- precizie 5 nm (senzor)

Vizualizare

- camera 768 x 494 pixeli
- lentila 200 mm

Procesari cu fascicule laser Gaussiene



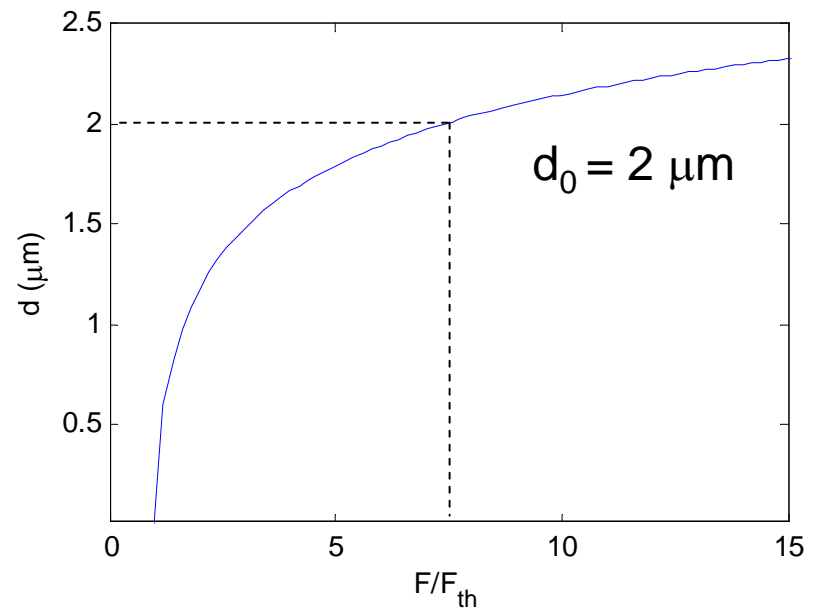
Procesarea materialelor prin ablatie laser se poate face cu precizie sub limita de difractie prin ajustarea corespunzatoare a fluentei laser.

$$d_0 = \frac{2M^2 \lambda}{\pi AN} \approx \frac{\lambda}{AN}$$

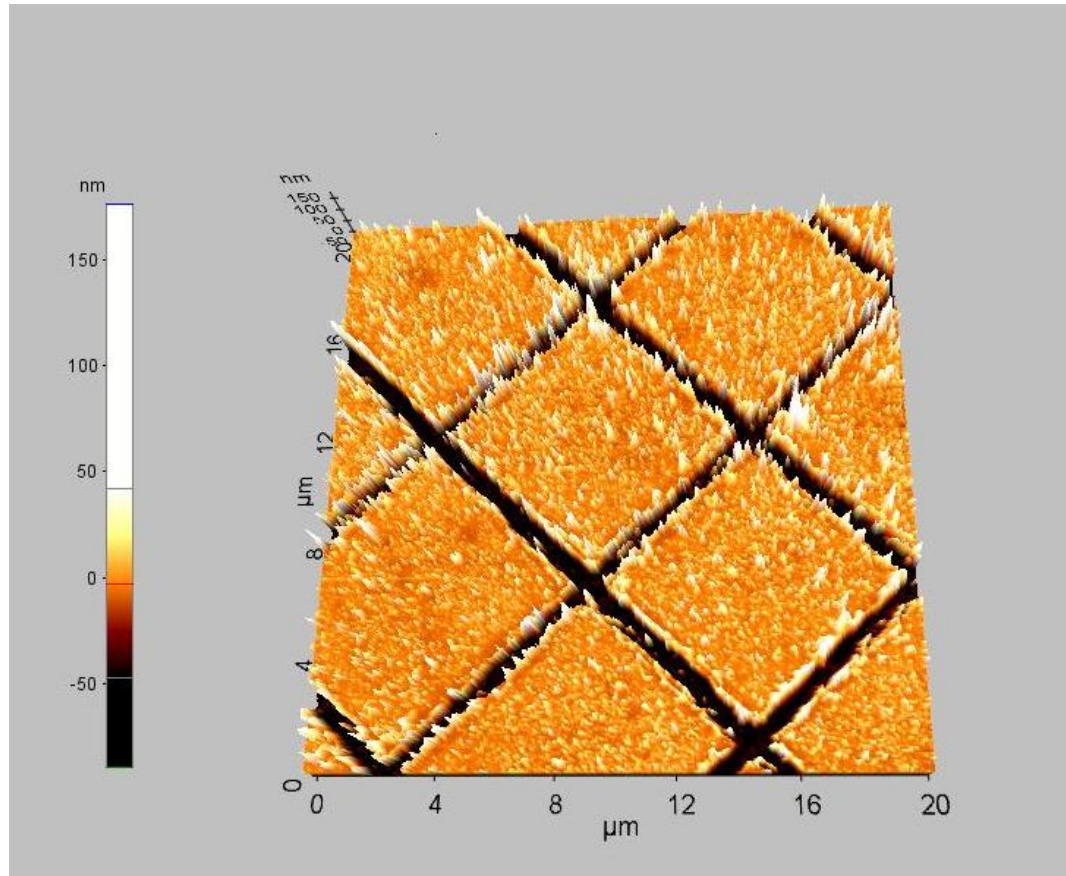
d_0 – diametrul minim al spotului laser focalizat

AN – apertura numerica

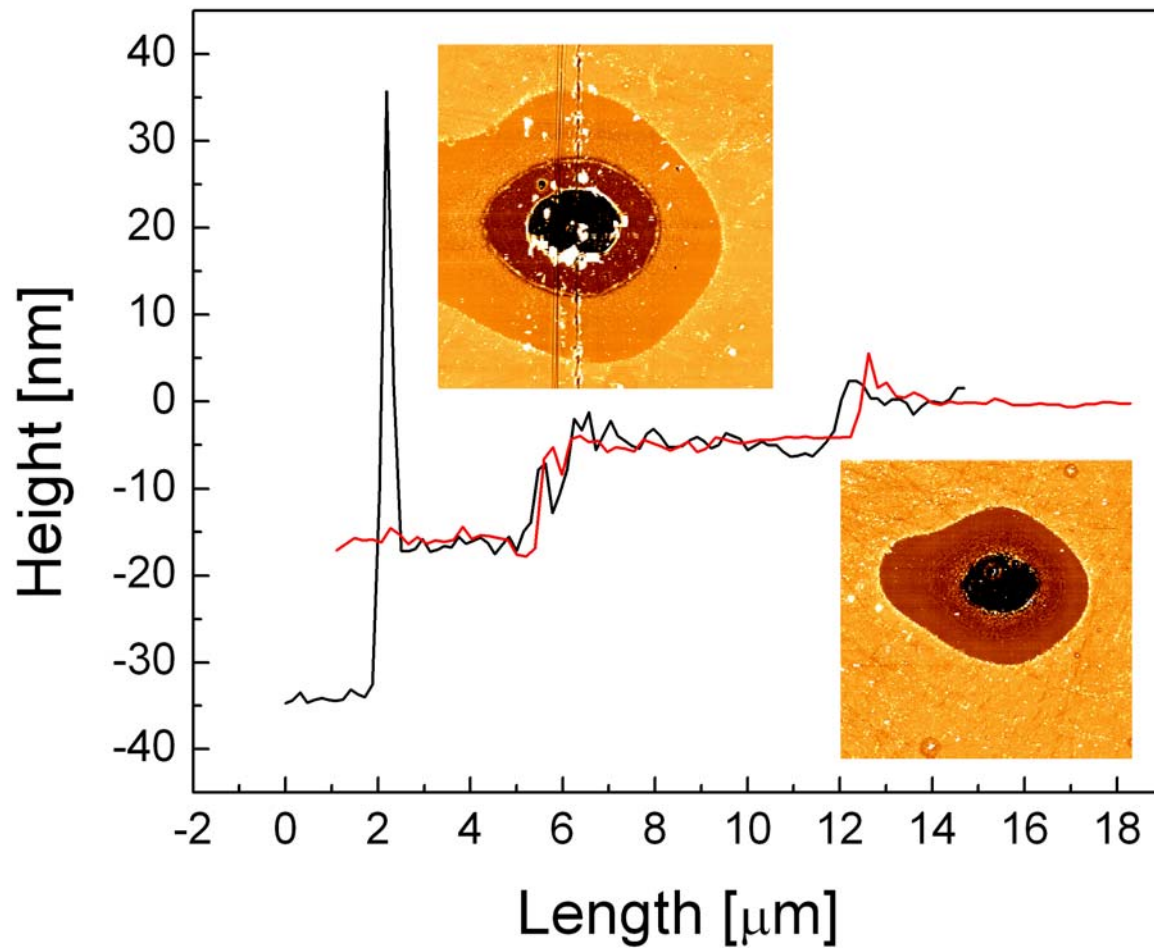
$$d(F) = \frac{d_0}{\sqrt{2}} \sqrt{\ln(F / F_{th})}$$



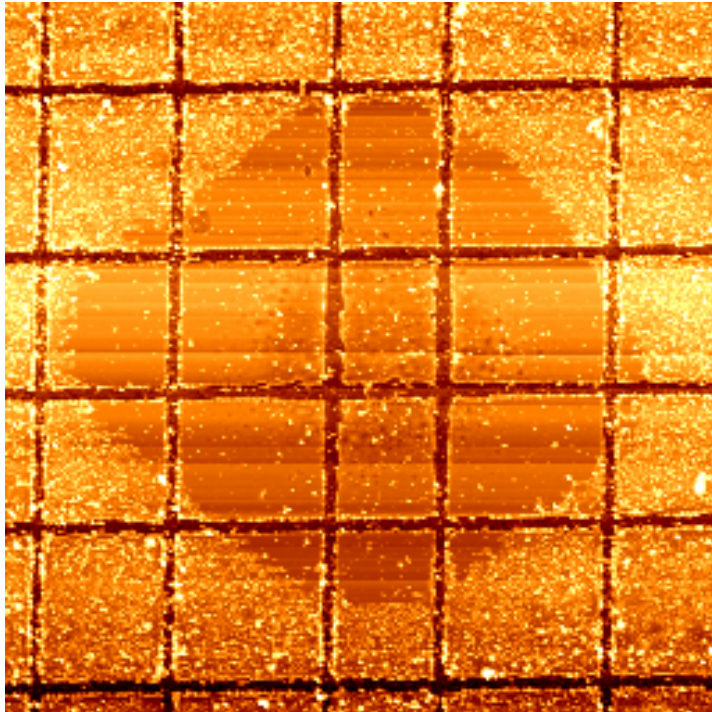
Substrat Si/SiO₂/Co 20 nm/Cu6nm/Co3nm



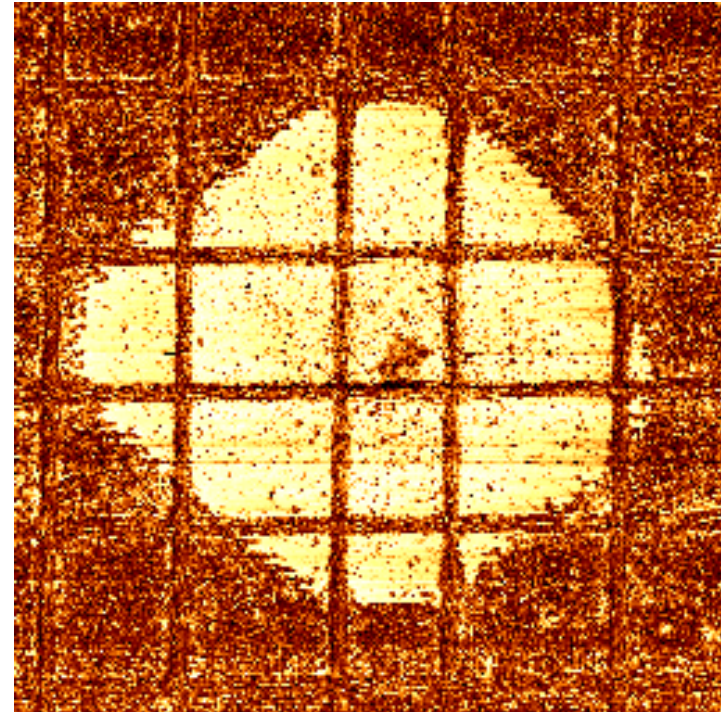
Ablatia laser a unei multistructuri Co/Cu/Co



Microscopie de forta atomica

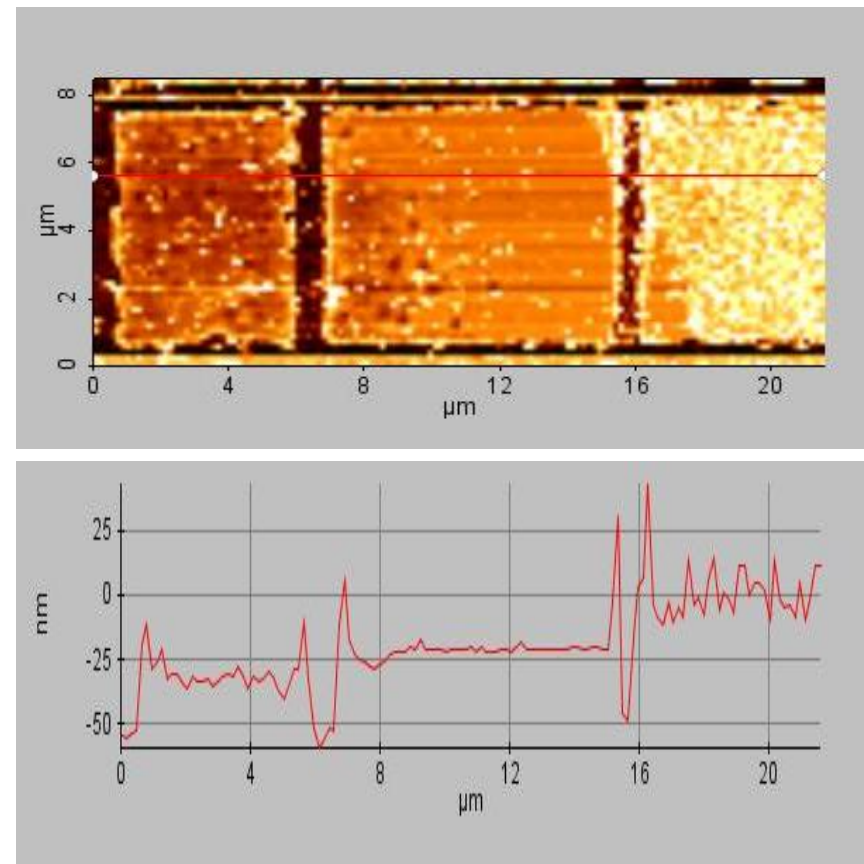
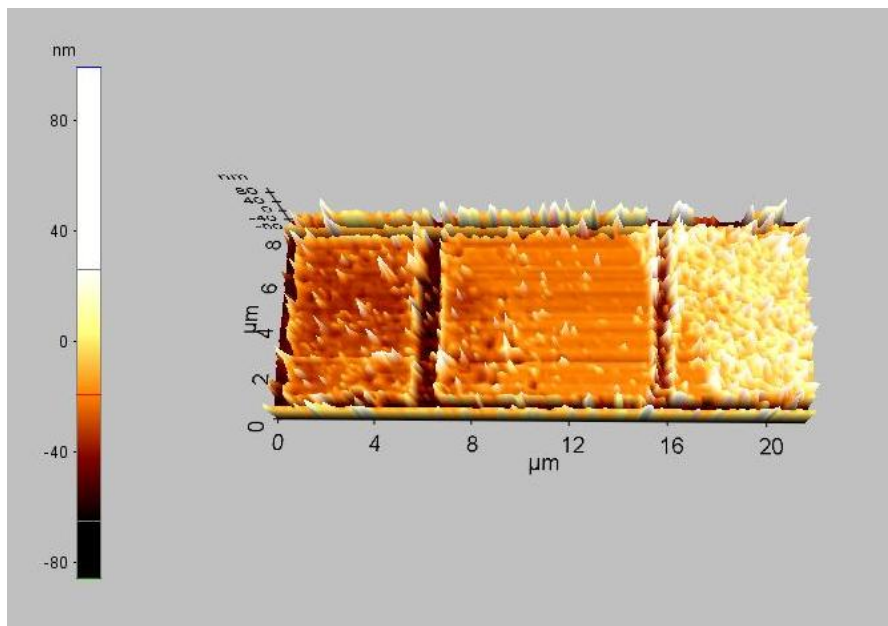


AFM – topografie

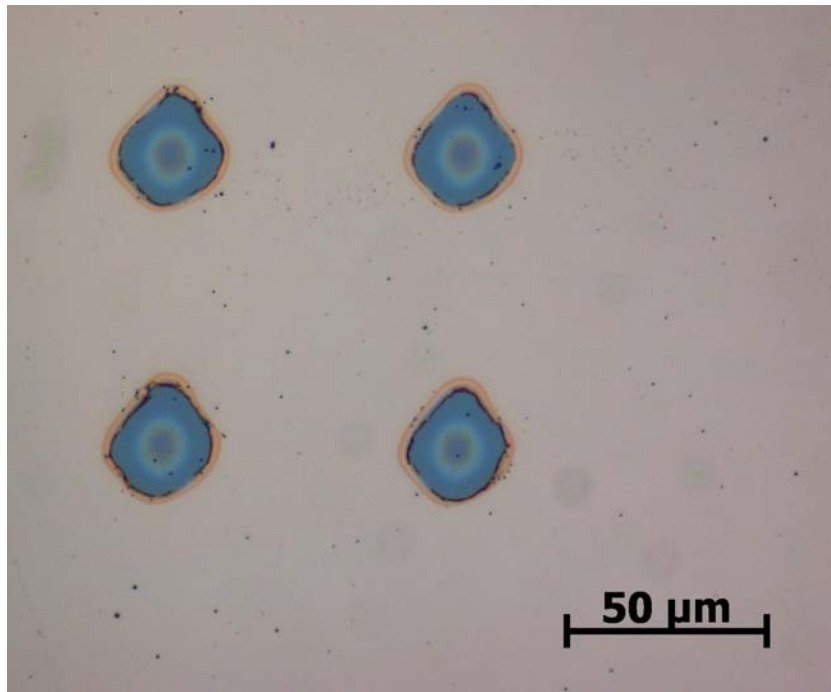


AFM – diferenta de faza

Litografiere cu laserul cu femtosecunde

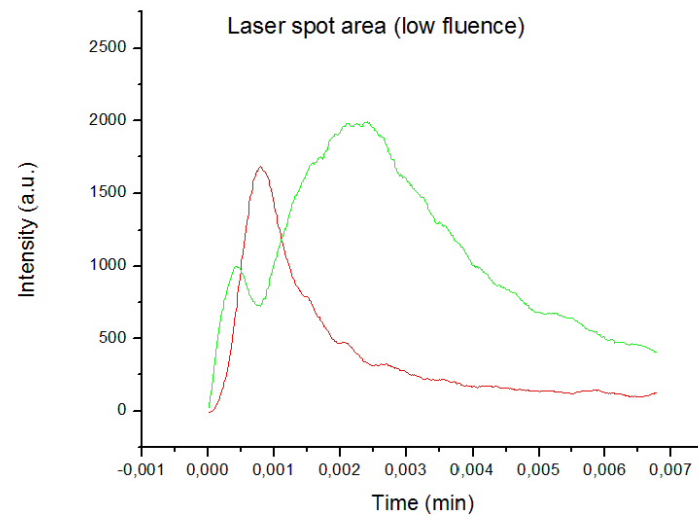
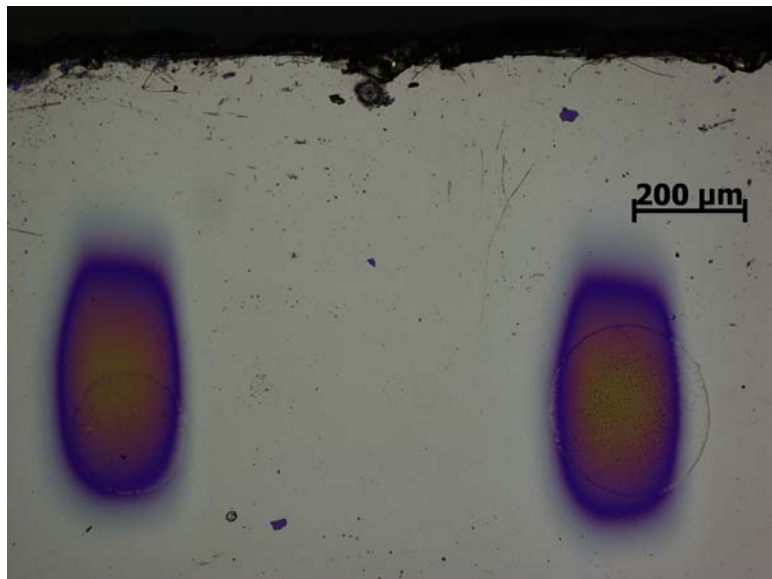
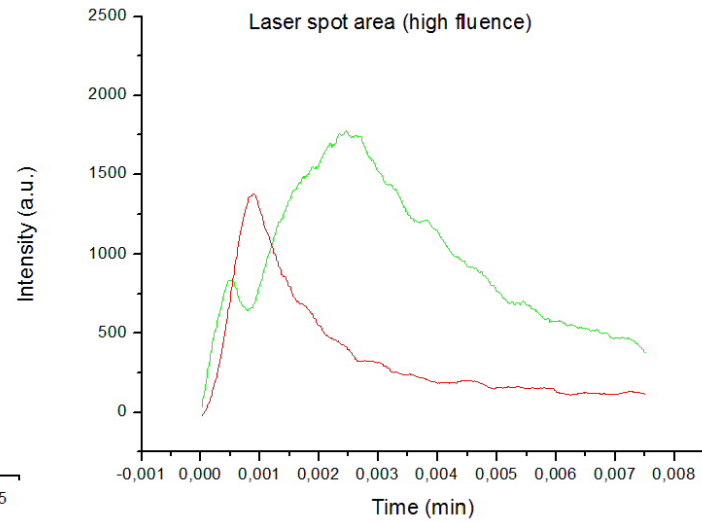
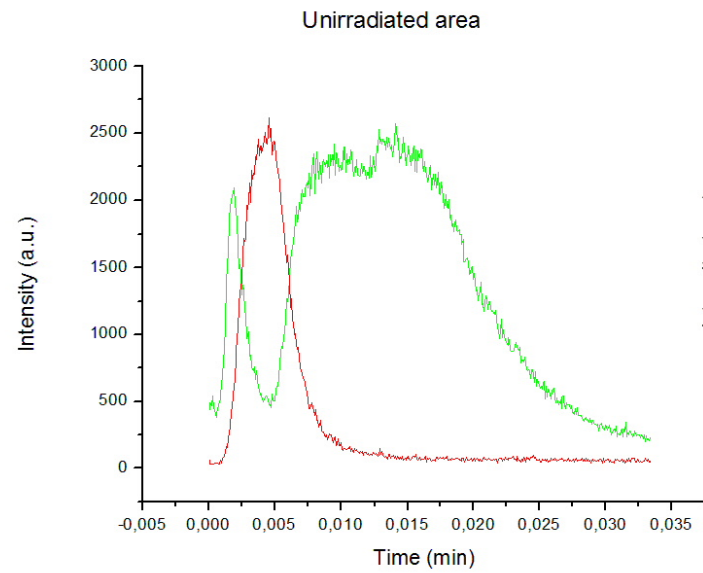


Praguri ablatie Co si Cu



| | Cupru | Cobalt |
|--|-------|--------|
| $\rho(\text{kgm}^{-3})$ | 8960 | 8900 |
| $L(10^5\text{Jkg}^{-1})$ | 2.05 | 2.74 |
| $T_m(\text{K})$ | 1358 | 1768 |
| $T_v(\text{K})$ | 2833 | 3200 |
| $K_s(\text{Wm}^{-1}\text{K}^{-1})$ | 397 | 100 |
| α_s | 115 | 27 |
| $k_l(\text{Wm}^{-1}\text{K}^{-1})$ | 170 | 30 |
| $\alpha_l(10^{-6}\text{m}^2\text{s}^{-1})$ | 43 | 6.1 |
| $E_{th} (\mu\text{J})$ | 0.6 | 5 |

Masuratori SIMS



Masuratori SIMS

