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Project Retention of heavy metals in LDH thin films obtained by laser ablation (PLD)

Period: *October – December 2011*

First year objectives:

- Deposition of thin films of Mg-Al LDH and Ni-Al LDH to serve as reference using PLD.

- Morphological and structural characterization of the as-deposited thin films.

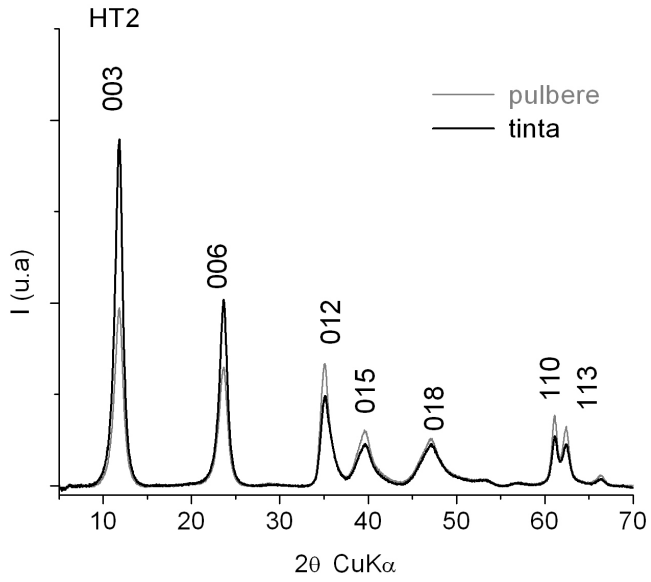
Layered double hydroxides (LDHs) are a class of layered materials consisting of positively charged brucite-like layers and exchangeable interlayer anions, which have received increasing attention in the last years, due to their versatility and to their prospects in a wide range of technological applications such as catalysis, separation, and environmental remediation.

LDHs formula is [M(II)1-xM(III)x(OH)2]-(Anx/ n)m H2O], where M(II) is a divalent cation (Mg2+, Ni2+, Zn2+, Cu2+ or Co2+) and M(III) is a trivalent caution (Al3+, Cr3+, Fe3+, or Ga3+). An- is an anion with charge n (ex.: CO2-3, Cl-, NO-3) or an organic anion. The x value varies between 0.2 and 0.4 and it determine the layer charge density and the anionic exchange capacity. Various divalent (MII= Mg, Zn, Ni) and trivalent (MIII=Al, Fe, Cr) cations in variable MII/ MIII mole ratios have been used to synthesize a wide range of LDHs materials. [1,2].

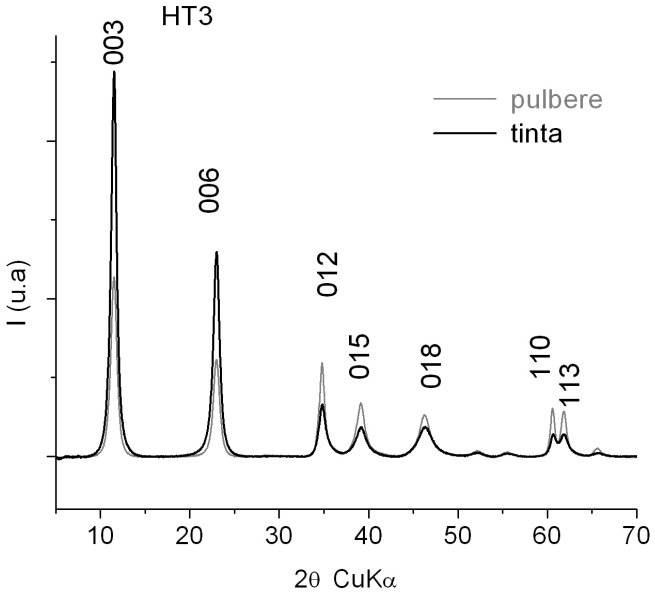
LDSs are generally prepared in powdered form but, in order ot be used as materials for functional coatings or in devices they must be fabricated into well-oriented supported or self supporting films.

Mg-Al (Mg/Al=2,3) LDH was prepared via co-precipitation at supersaturation,and pH=10, using aqueous solutions of Mg and Al nitrates, sodium hydroxide and carbonate . The obtained gels have been dried at 85oC for 24 h. The LDHs powders was calcinated under mild condition at 460oC for 18 h under nitrogen flow. HT2 and HT3 targets were pressed at 100 atm as pressed round pellets.

The targets were investigated by XRD and compared with the powder pattern (Fig. 1a si 1b).



(a)



(b)

Fig. 1 a, b. XRD pattern of powder and targets with different molar ratio Mg/Al=2 (a) and Mg/Al=3 (b).

We observed that the hidrotalcite structure is preserved.

In order to obtain thin films of layered double hydroxide we tested more parameters. (Tabel 1).

Tabel 1.

Parametrii	Valori
Tipul de laser	KrF, Nd:YAG
Lungimea de unda Rata de repetitive laser Fluenta laser Distanta tinta-substrat Numar de pulsuri	193 nm, 266 nm, 532 nm, 1064 nm 1-50 Hz 0.5-6 J/cm^2 4-5 cm 10.000-24.000
Presiunea vidului	~10^{-3} – 10^{-6} mbar
Substrat Temperatura substratului (^oC)	sticla, Si 20-350

The obtained samples will be investigated and the best deposition conditions will be kept for further sample deposition.

Referinte:

1. V. Rives, Layered Double Hydroxides, Nova Science, Huntington, New York, 2001
2. A. Matei. R. Birjega, A. Nedelcea, A. Vlad, D. Colceag, M. D. Ionita, C. Luculescu, M. Dinescu, R. Zavoainu, O. D. Pavel, Applied Surface Science, 257 (2011) 5308-5311

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