Preparation and Characterization of Some Lanthanide Compounds with Pyridinium Ligands as Thin Films with Sensing Potential

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Objectives

- Preparation of lanthanide (La, Nd) compounds with pyridinium ligands; spectroscopic and analytical data for compounds are provided.
- An explorative study to obtain thin films for chemical sensor applications using the matrix assisted pulsed laser evaporation MAPLE technique (KrF excimer laser).

Materials and methods

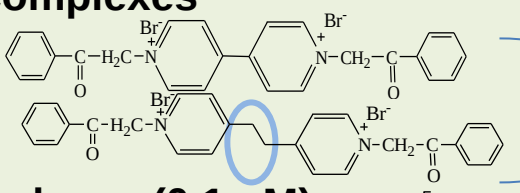
- Quaternary pyridinium salts derived from **4,4'-bipyridinium** (**Lr**) and **1,2-bis-(4-pyridinium)ethane** (**Lf**); **La**nthanum(III) and **N**eo**d**ymium(III) sulfate in methanol **(**MeOH), triethylamine (Et_3N).
- Spectrophotometric (UV-Vis, FTIR) and conductometric measurements of the lanthanide complexes.
- SEM investigation and FTIR analysis of the deposited films.

Synthesis of lanthanide complexes

Pyrididium ligands → *Lanthanide Compounds*

Lr:

Lf:



MeOH/ (Et_3N

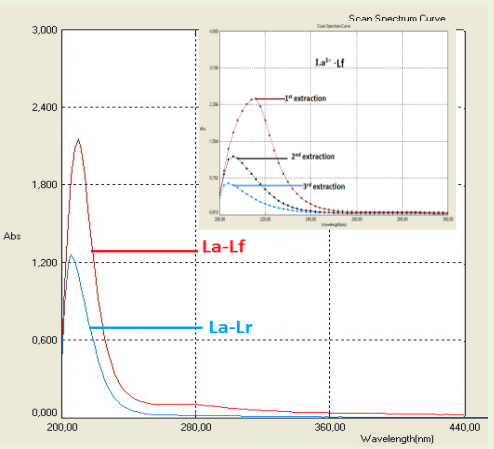
t medium/agitation

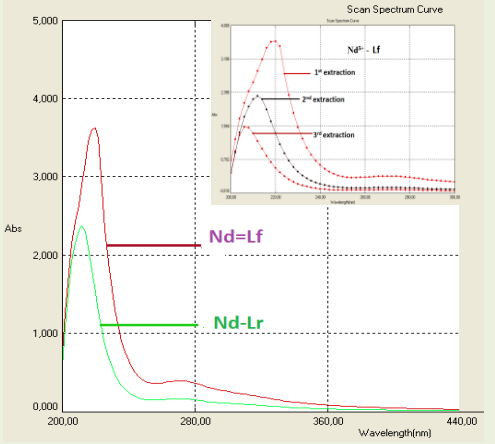
La: Lr(Lf):Et_3N:MeOH

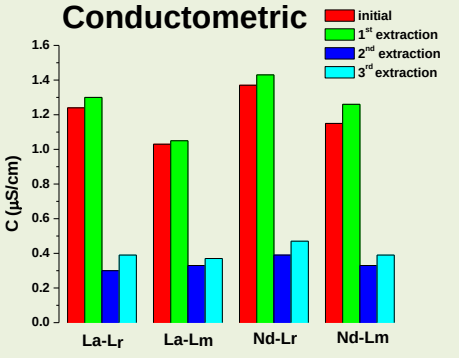
Nd: Lr(Lf):Et_3N:2MeOH

UV-Vis of lanthanide complexes (0,1mM)

(spectrophotometer T90+)

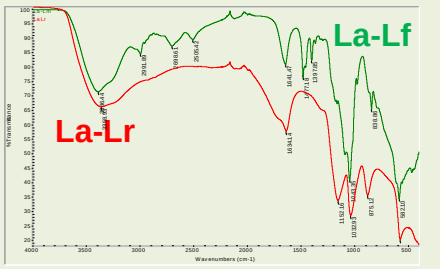






FT-IR analysis

(sursa)

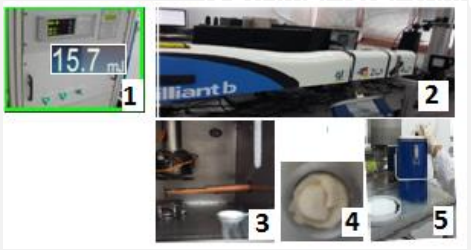


Explorative MAPLE

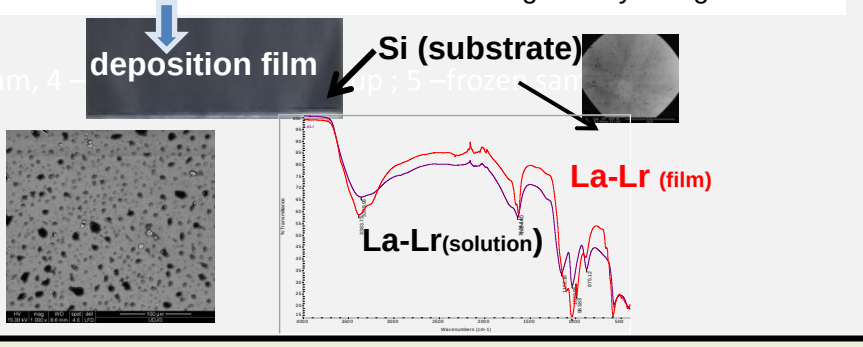
(Matrix Assisted Pulsed Laser Evaporation)

Deposited materials of Ln(III) pyridinium compounds are embedded in frozen matrix (water) at the temperature of liquid nitrogen on Si substrate. Small molecules of matrix are pumped away from the deposition chamber, while molecules of Ln complexes are incident on the sensor substrate and a thin organic layer is grown.

A pulsed KrF* excimer laser source (λ = 266 nm, τ = 25 ns, v = 10 Hz)



1 - excimer laser source
2 - laser beam energy
3 - chamber vaccum
4 - sample in metallic cup
5 - frozen sample



Conclusions

Antitumor potential of lanthanide underpins recent research for obtaining new molecules used in cancer diagnosis and therapy. Lanthanides promote cell proliferation and induce apoptosis. Thus, the new compounds were investigated as inhibitors, cytotoxic agents, radiation therapy and photodynamic therapy as biosensors.

MAPLE has become an active area of research for the deposition of a variety of polymer, biological, and organic thin films.

The potential of MAPLE technique for producing thin films derived from heterocyclic compounds could be explored.

Scanning electron microscopy data indicated that MAPLE may be used to fabricate thin films of good morphological quality.

References

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2. Datcu, A., Duta, L., Perez del Pino A., Logofatu, C., Luculescu, C., Duta, A.., Perniud D., and Gyorgy E., One-step preparation of nitrogen doped titanium oxide/Au/reduced graphene oxide composite thin films for photocatalytic applications, RSC Adv., 2015, 5, 49771.

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