Elaboration of ZnS nanoparticles in sol-gel thin films

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Objectives :

ZnS NANOPARTICLES GROWTH IN MESO-STRUCTURED SILICA THIN FILMS :

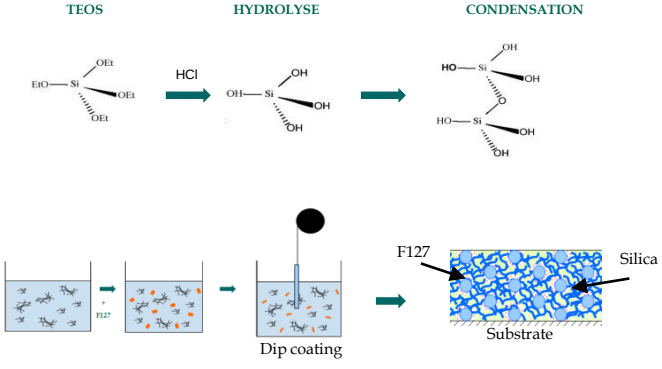
- LOCALIZED AND CONTROLLED GENERATION OF NANOPARTICLES
- SELF-ORGANIZED NANOPARTICLES AT THE NANOMETER SCALE : CONTROL OF INTER-PARTICLE DISTANCE
- CONTROL OF THE KINETIC OF THE NANOPARTICLES FORMATION

Investigated material : Zinc sulfide ZnS

- Wide direct band gap semiconductor (3.68 eV for bulk).
- Good emitters of light
  - ➔ many applications as phosphors, labels for cellular imaging, …
- Good photocatalyst ➔ photodegradation of organic pollutants (dyes, rhodamine, eosin, p-nitrophenol...).
- ZnS high optical index ➔ application in BIP photonic devices.

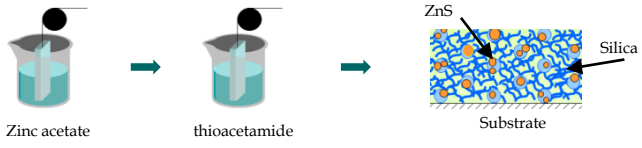
Elaboration of meso-structured thin films by sol-gel process :

To control the size and the organization of nanoparticles => use of mesostructured films as mold for the growth



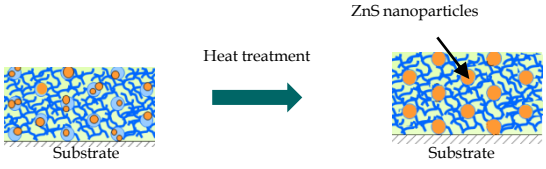
ZnS noparticles nucleation

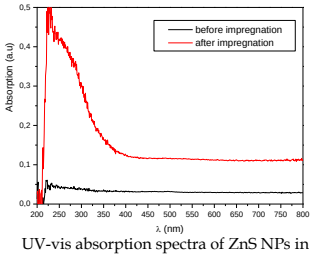
Impregnations :



ZnS noparticles Growth

=> use of heat treatment





UV-vis absorption spectra of ZnS NPs in film

❖ UV-Visible absorption :

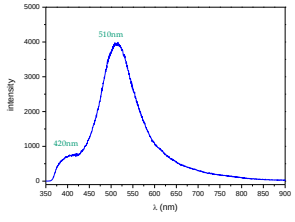
ZnS NPs absorption band ~ 300nm

Blue shift of the wavelength from 340 nm (bulk ZnS) => quantum size effect.

❖ Photoluminescence

Stable blue and green emission

=> Presence of self activated luminescencecenters (vacancy, interstitial states) in ZnS NPs.



Photoluminescence spectrum of ZnS NPs

CONCLUSION

- **A process for a local growth of ZnS NP in thin films**
- **ZnS NP grow in place of the copolymer micelles**
- **The ZnS NP size increases until it reaches the pore size**

PERSPECTIVES

- **Control the ZnS NP Growth in the mesoporous structure**
- **Control of the NP organisation**
- **Study the interaction between organized nanoparticles**
- **Formation and study of diffractive structures**

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Myriam MOUSSAOUI holds a fellowship from the region Rhone-Alpes (MIRA).