



Erbium-doped spinels obtained from organometallic precursors

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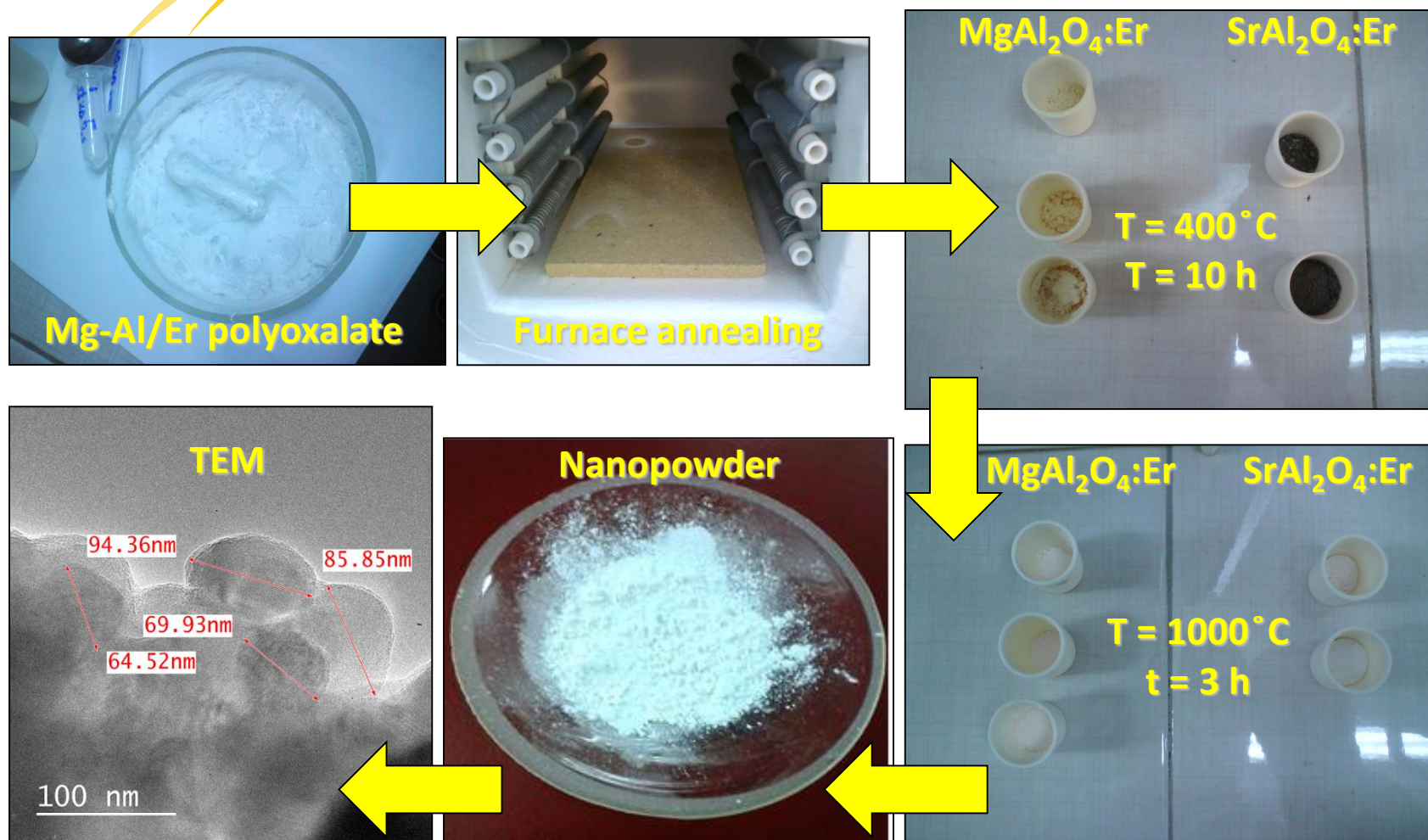
Work aim

- ❖ Preparation of lanthanide-doped spinel nanopowders and investigation of their optical properties for possible use as materials for visualizing UV radiation.

Questions

- ❖ Can thermal decomposition of organometallic precursors be used to obtain spinel nanopowders?
- ❖ Do lanthanide-doped spinels exhibit VIS luminescence under UV radiation?
- ❖ Is it possible to introduce spinel nanopowders in transparent polymers?

General working protocol for synthesis of luminescent nanoparticles



Determination of water content in nitrate precursors (through annealing)

Mărimea ▼ / Compusul ►	Mg(NO ₃) ₂ ·6H ₂ O	Sr(NO ₃) ₂	Al(NO ₃) ₃ ·9H ₂ O	Y(NO ₃) ₃ ·6H ₂ O	Er(NO ₃) ₃ ·5H ₂ O	La(NO ₃) ₃ ·6H ₂ O	Ga(NO ₃) ₃ ·xH ₂ O
Valența metalului	2	2	3	3	3	3	3
Masa molară a hidratului [g/mol]	256.41	211.63	375.13	383.01	443.35	433.01	417.87
Masa molară a substanței anhidre [g/mol]	148.32	211.63	213.00	274.92	353.27	324.92	255.74
Masa atomică a metalului [g/mol]	24.31	87.62	26.98	88.91	167.26	138.91	69.73
Masa molară a oxidului final [g/mol]	40.31	103.62	101.96	225.81	382.51	325.81	187.45
Numărul moleculelor de apă (teoretic)	6.0	0.0	9.0	6.0	5.0	6.0	9.0
Masa de probă inițială [g]	1.0188	1.1185	1.0567	0.3752	0.1086	0.2006	1.1305
Masa de probă finală [g]	0.1630	0.5316	0.1599	0.1097	0.0449	0.0866	0.2394
Masa de substanță anhidră [g]	0.600	1.086	0.668	0.267	0.083	0.173	0.653
Numărul moleculelor de apă (experimental)	5.75	0.35	6.88	6.17	6.07	2.91	10.37
Masa molară corectată a hidratului [g/mol]	251.94	218.02	336.90	386.16	462.59	377.35	442.58

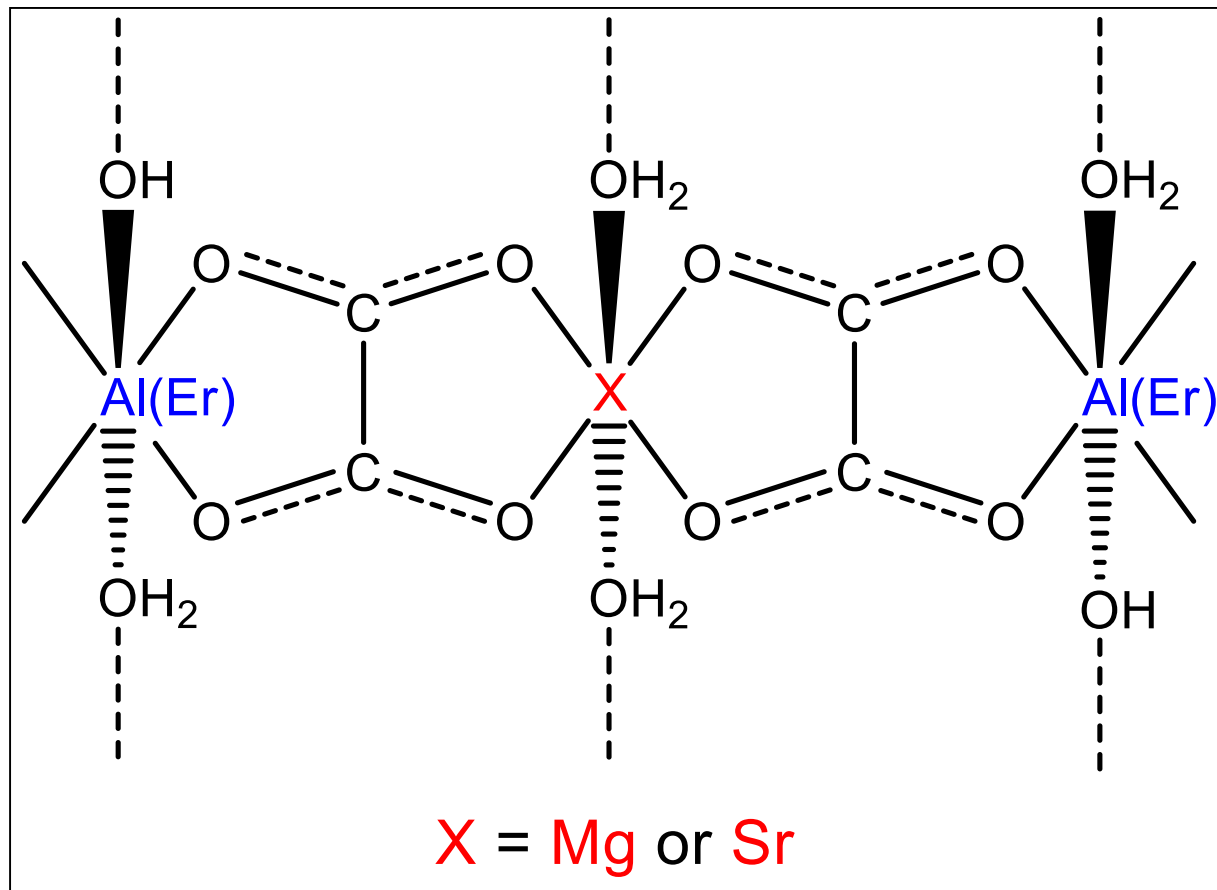
Synthesis of Mg-Al/Er (left) and Sr-Al/Er (right) polyoxalates



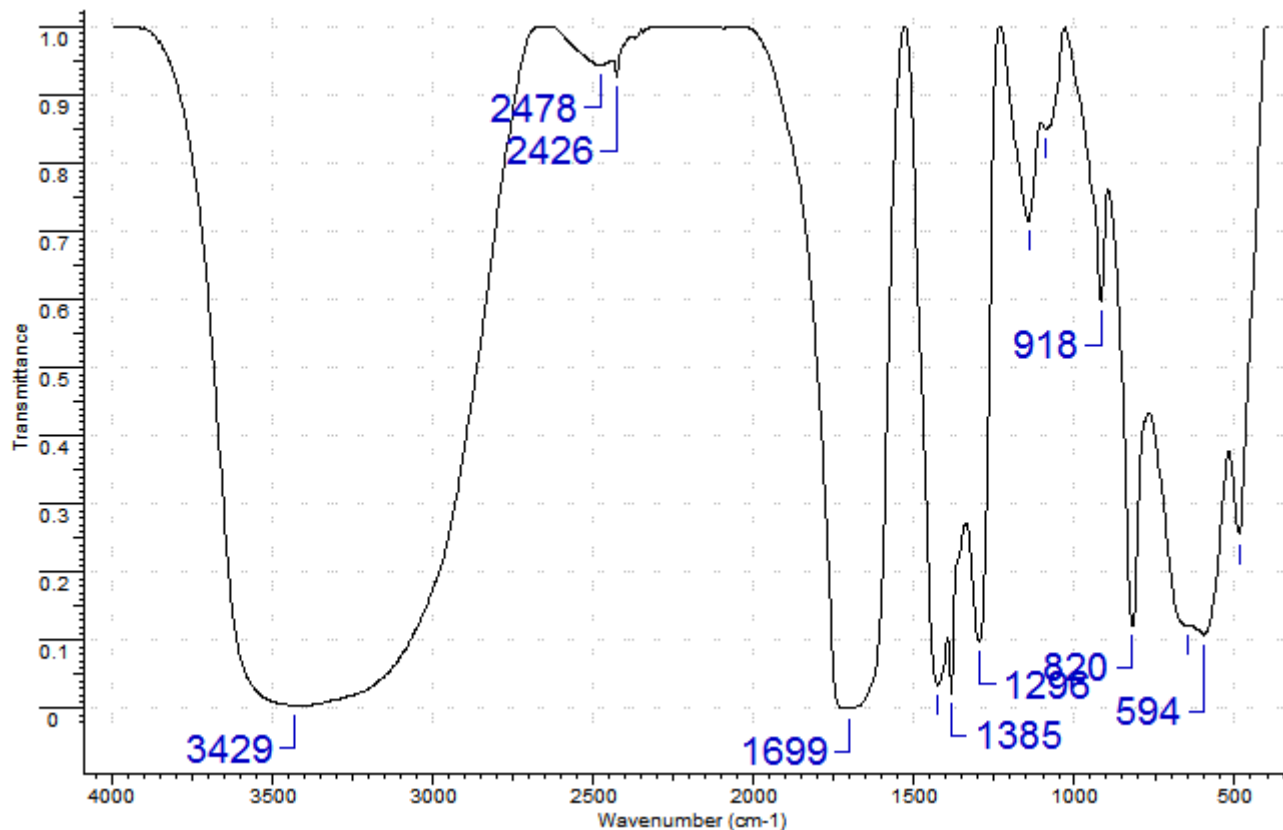
The obtained Mg-Al/Er (left) and Sr-Al/Er (right) polyoxalates



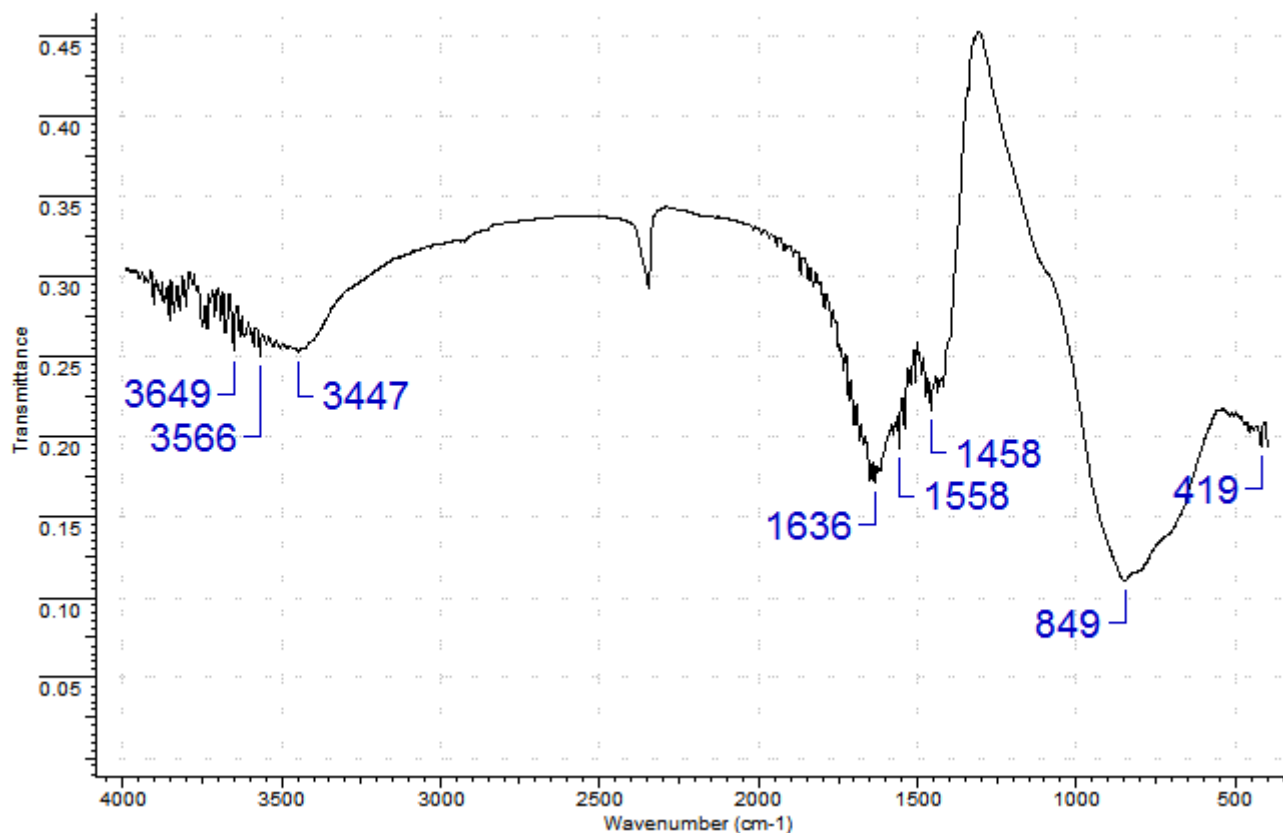
Proposed general structure for **Mg-Al/Er** and **Sr-Al/Er** polyoxalates



FTIR spectrum of Mg-Al polyoxalate



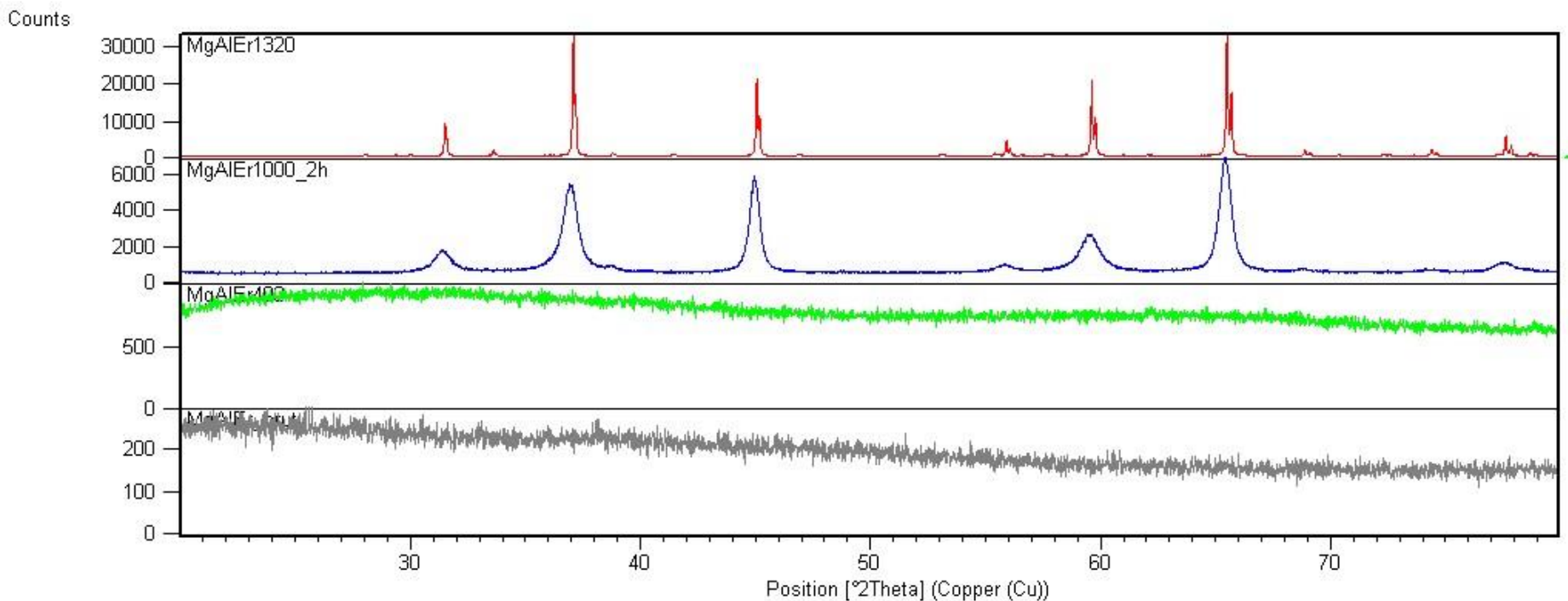
FTIR spectrum of annealed product (500 °C)



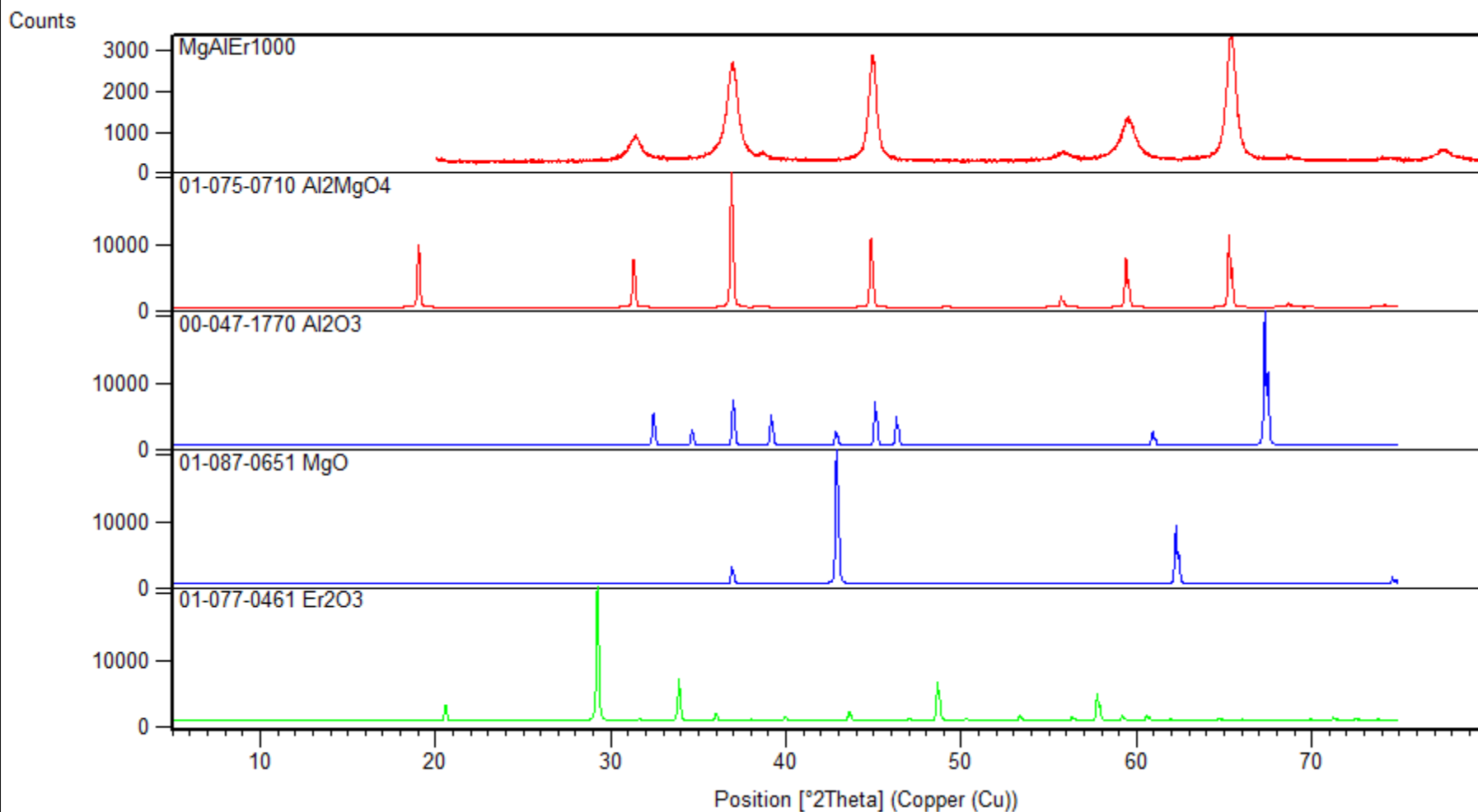
FTIR spectrum of annealed product (1000 °C)



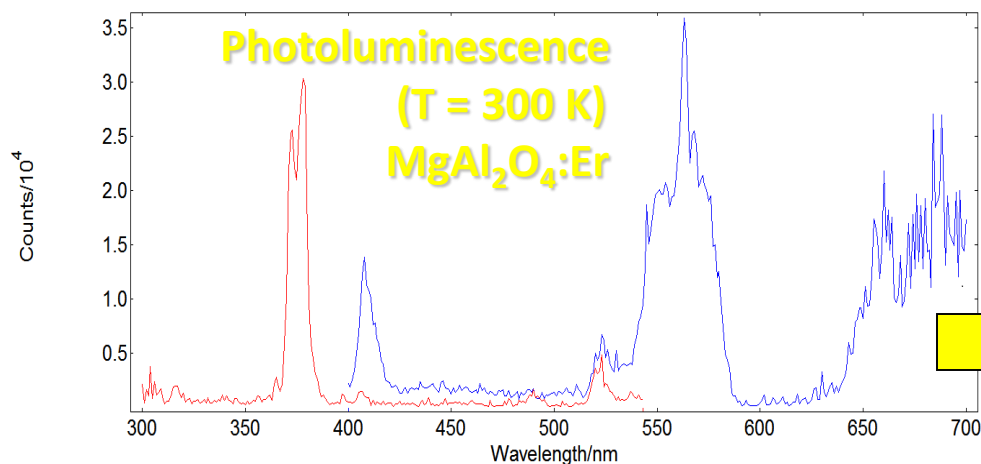
XRD spectra of annealed products: 400, 1000 and 1320 °C



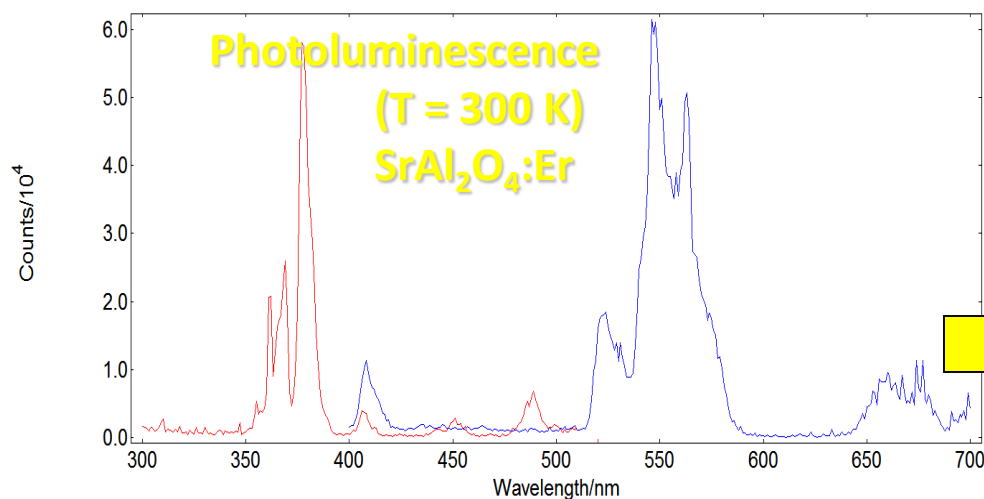
Phase purity of the obtained spinel shown using XRD (top pattern)



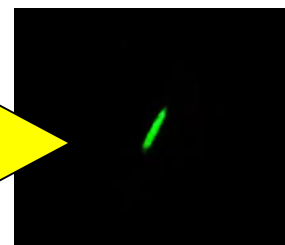
Photoluminescence spectra of the obtained spinels



Light emission
of MgAl₂O₄:Er
under UV



Light emission
of SrAl₂O₄:Er
under UV

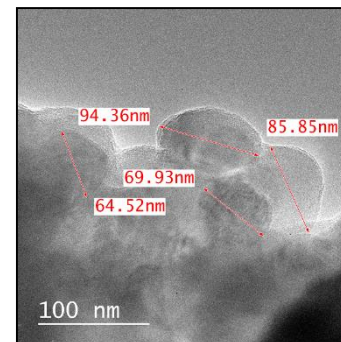
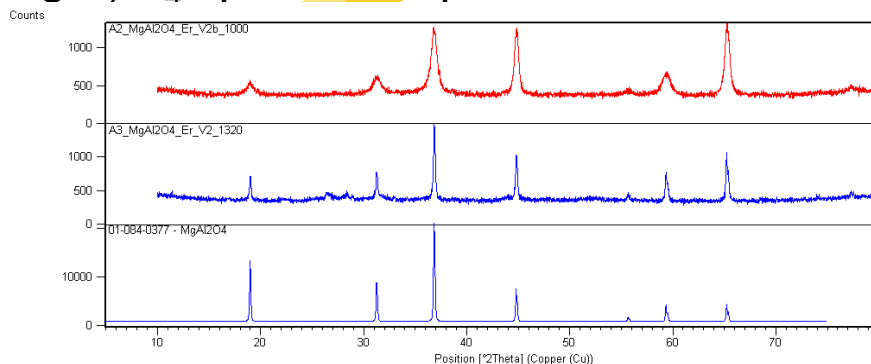


Integration of luminescent nanopowder in transparent polymer for obtaining the final nanocomposite

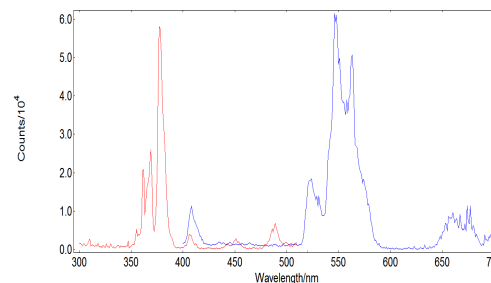
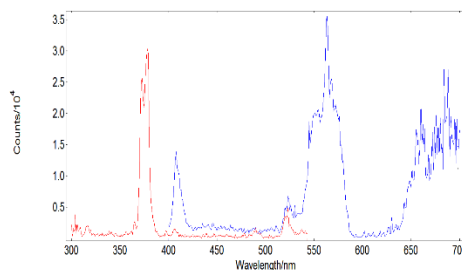


Conclusions

- ❖ Thermal decomposition of organometallic precursors can be used to obtain SrAl_2O_4 and MgAl_2O_4 spinel nanopowders:



- ❖ Lanthanide-doped spinels absorb UV radiation:



- ❖ After incorporation in a polymeric matrix, the obtained oxide powder may serve as a potential visualizer of UV radiation of specific wavelengths in a dark environment:





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1. Niculescu M., Pascariu M.C., Muntean C., Sasca V., Lupa L., Milea M.S., Bîrzescu M. *Thermal and spectroscopic analysis of Co(II)–Fe(III) polyglyoxylate obtained through the reaction of ethylene glycol with metal nitrates*. J. Therm. Anal. Calorim. (2017), doi: 10.1007/s10973-016-6079-1.
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3. Niculescu M., Racu A., Linul P., Țăranu B., Pascariu M.C. *TEM, EDX and Raman study of nickel oxide micro- and nanophases obtained by thermal decomposition of an organometallic precursor*, Proceedings of The 22nd International Symposium on Analytical and Environmental Problems, October 10, 2016, Szeged, Hungary, p. 255-258.

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A 16-a ediție a Seminarului Național de Nanoștiință și Nanotehnologie

București, Biblioteca Academiei Române, 6 iunie 2017