Third International Conference on

Multifunctional, Hybrid and Nanomaterials

3-7 March 2013, Sorrento, Italy

Programme Book

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Conference Overview

Sunday 3rd March		
11.00 - 14.00	Conference Registration	Congress Centre Foyer
14.00 - 14.15	Welcome Remarks	Sirene Auditorium
14.15 - 15.00	Plenary Lecture 1: *Sir Fraser Stoddart, Northwestern University, USA*	Sirene Auditorium
15.00 - 16.00	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
16:00 - 17:00	Coffee Break and Poster Session 1	Foyer
17.00 -18.20	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
18.25 - 19.10	Tutorial 1: Carbon- and carbon nitride hybrids for energy storage, electrocatalysis, and Mott-Schottky catalysis *M. Antonietti, Max-Planck-Institut für Kolloid- und Grenzflächenforschung, Germany*	Sirene Auditorium
19:10 - 21:00	Welcome Reception & Poster Session 1 (Continuation)	Foyer
Monday 4th March		
08.30-09.15	Plenary lecture 2: From nanostructured to hierarchically structured functional inorganic and hybrid solids *C. Sanchez, Collège de France, France*	Sirene Auditorium
09.20-10.20	4 Parallel Sessions: Symposium A, B, B1 and C	Sirene Auditorium, Ulisse, Tritone, Nettuno
10.20-11.20	Coffee Break and Poster Session 2	Foyer
11.20-12.30/40	4 Parallel Sessions: Symposium A, B, B1 and C	Sirene Auditorium, Ulisse, Tritone, Nettuno
12.30-14.10	Lunch	San Antonio & Ginestre
14-10-16.40/50	4 Parallel Sessions: Symposium A, B, B1 and C	Sirene Auditorium, Ulisse, Tritone, Nettuno
16.40-17.15	Coffee Break	Foyer
17:15 – 18:00	Tutorial 2: Supramolecular materials *S.I. Stupp, Northwestern University, USA*	Sirene Auditorium
18.00-19.30	Poster session 2 (Continuation)	Foyer
Tuesday 5th March		
08.00-08.45	Plenary Lecture 3: Heterogeneity within the order of MOFs *O.M. Yaghi, University of California at Los Angeles, USA*	Sirene Auditorium
08.50-09.50	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
09.50-10.50	Coffee Break & Poster Session 3	Foyer
10.50-12.00	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
12.00-13.30	Poster Session 3 (Continuation)	Foyer
	Free Afternoon and Evening	
Wednesday 6th March		
08.30-09.15	Plenary lecture 4: Generating and sustaining force. Structure and function of natural hybrid materials *P. Fratzl, Max Planck Institute of Colloids and Interfaces, Germany*	Sirene Auditorium
09.20-10.20	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
10.20-10.50	Coffee Break	Foyer
10.50-12.40	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
12.40-14.10	Lunch	San Antonio & Ginestre
14.10-16.40	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
16.40-17.15	Coffee Break	Foyer
17:15 - 18:00	Tutorial 3: Functional porous materials - Preparation and applications, *K. Kuroda, Waseda University, Japan*	Sirene Auditorium
19:30 - 22:30	Optional Conference Dinner at Ristorante O' Parrucchiano	
Thursday 7th March		
08.30-09.15	Plenary Lecture 5: Structural control from molecular up to macroscopic size regimes for developing functional soft materials *T. Aida, University of Tokyo, Japan*	Sirene Auditorium
09.20-10.20	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
10.20-10.50	Coffee Break	Foyer
10.50-12.40	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
12.40-14.00	Lunch	San Antonio & Ginestre
14.00-17.00	3 Parallel Sessions: Symposia A, B and C	Sirene Auditorium, Ulisse, Nettuno
17.05-17.20	Closing Remarks	Sirene Auditorium

	N. Pazos Perez*[1], M. Tebbe[1], M. Mueller[1], R. Alvarez Puebla[2], A. Fery[1], [1]*University of Bayreuth, Germany,* [2]*University of Vigo, Spain*
	SYMP. B - Sol-gel derived hybrids
[B.1.8.1]	**Proton-conducting hybrid materials and their structural properties** U. Thanganathan, *Okayama University, Japan*
[B.1.8.2]	**Nanostructured innovative materials designed for medical applications** V. Vickackaite*, J. Trinkunaite-Felsen, A. Beganskiene, A. Padarauskas, A. Kareiva, *Vilnius University, Lithuania*
[B.1.8.3]	**Synthesis, modification and functionalization of silica nanocoatings** A. Padarauskas*, I. Valasinaviciute, A. Beganskiene, S. Tautkus, *Vilnius University, Lithuania*
[B.1.8.4]	**Designing epoxy-silica hybrids for cold-curing systems in structural applications** F. Lionetto*[1], L. Mascia[2], M. Frigione[1], [1]*University of Salento, Italy,* [2]*Loughborough University, UK*
[B.1.8.5]	**Preparation and Optical Properties of Hybrid Silica Sol-Gel Materials** N. Danchova*, S. Gutzov, *University of Sofia, Bulgaria*
[B.1.8.6]	**New organic-inorganic hybrids: Alkoxysilyl-functionalised mesylate and iodide imidazolium-based ionic liquids** A. Surca Vuk*, M. Colovic, M. Hajzeri, L. Slemenik Perse, B. Orel, *National Institute of Chemistry, Slovenia*
[B.1.8.7]	**Photoluminescent silica aerogel containing new developed lanthanide complexes** C.S. Stan[1], M. Popa*[1], N. Marcotte[2], [1]*TUIASI, Romania,* [2]*Ecole Nationale Supérieure de Chimie, France*
[B.1.8.8]	**Development of water-based sol-gel coatings as adhesion pre-treatment for aluminium sheets** S. Meyer*, U. Schubert, *Technical University of Vienna, Austria*
[B.1.8.9]	**Preparation and characterization of shape memory hybrids** S. Ponyrko*, L. Matejka, *Institute of Macromolecular Chemistry, Czech Republic*
[B.1.8.10]	**Adsorption of hazardous dyes orange ii and methylene blue on ureasil-PEO hybrid matrix** E.F. Molina*, L. Marçal, E.J. Nassar, K.J. Ciuffi, *Universidade de Franca, Brazil*
[B.1.8.11]	**Ion imprinted sol-gel materials for the separation of metal ions** S. Umetani*, K. Watanabe, Y. Sohrin, *Kyoto University, Japan*
[B.1.8.12]	**Tunable photoluminescence by energy transfer from Tb^{3+} to Eu^{3+} in GPTS-TEOS-derived organic/silica hybrid films** F.S. De Vicente*[1], L.A.O. Nunes[2], P. Freddi[1], D.A. Donatti[1], D.R. Vollet[1], [1]*UNESP, Brazil,* [2]*USP, Brazil*
	SYMP. C - Carbon-related functional porous materials
[C.1.1.1]	**Salt templating - A simple pathway toward highly porous ionic liquid-derived functional carbons and composites** N. Fechler*, T.P. Fellinger, M. Antonietti, *Max Planck Institute of Colloids and Interfaces, Germany*
[C.1.1.2]	**Deep-eutectic solvents playing multiple roles in the synthesis of hierarchical porous carbons** D. Carriazo, M.C. Gutierrez, M.L. Ferrer, F. del Monte, *ICMM-CSIC, Spain*
[C.1.1.3]	**Waterborne porous carbons for energy storage** M.M. Titirici*[1,2], R.J. White[1,3], S.A. Wohlgemuth[1], K. Tang[4], [1]*Max-Planck Institute of Colloids and Interfaces, Germany,* [2]*University of London, UK,* [3]*Berlin Institute of Technology, Germany,* [4]*Max-Planck Institute for Solid State Research, Germany*
[C.1.1.4]	**A sustainable production of porous carbon monoliths using hydrothermal carbonization** M.M. Titirici*[1,2], R.J. White[1,3], N. Brun[1], S. Kubo[1,4], [1]*Max-Planck Institute of Colloids and Interfaces,Potsdam, Germany,* [2]*University of London, UK,* [3]*Berlin Institute of Technology, Germany,* [4]*National Instituteof Advanced Industrial Science and Technology, Tsukuba, Japan*
[C.1.1.5]	**Obtainning of nanostructured carbon materials from biomass for adsorption of antibiotic** J. Schultz*[1,2], S. Pianaro[3], A.S. Mangrich[1,2], G. Capobianco[3], [1]*Federal University of Paraná, Brazil,* [2]*National Institute of Science and Technology, Brazil,* [3]*State University of Ponta Grossa, Brazil*
[C.1.1.6]	**Synthesis and characterization of nanoporous organic frameworks and their application to hydrogen storage** O.M. El-Kadri*[1], T. Islamoglu[2], R.M. Kassab[3], C.T. Jackson[2], H.M. E-Kaderi[2], [1]*American Univeristy of Sharjah, United Arab Emirates,* [2]*Virginia Commonwealth University, USA,* [3]*Cairo University, Egypt*
[C.1.1.7]	**Preparation of high crystalline mesoporous carbon powders through transition metal dispersed carbon powders** T. Tsumura*, S. Ninomiya, G. Shimizu, A. Arikawa, Y. Arai, M. Toyoda, *Oita University, Japan*
	SYMP. C - COFs
[C.1.2.1]	**Thin films of covalent organic frameworks - Synthesis and characterization** M.S. Lohse*, D.D. Medina, M. Dogru, A. Gavryshin, P. Knochel, T. Bein, *Ludwig-Maximilians University Munich, Germany*
	SYMP. C - Hierarchically structured materials
[C.1.3.1]	**Colloidal and optical characterization of hybrid clay-dye nanopigments: From fundamentals to applications** E. Baena-Murillo*, B. Micó-Vicent, F.M. Martínez-Verdú, *Universidad de Alicante, Spain*
[C.1.3.2]	**Photocatalytic TiO_2 macroscopic fiber obtained through integrative chemistry** N. Kinadjian*[1], M. Le Bechec[3], F. Dufour[4], E. Prouzet[2], S. Lacombe[3], R. Backov[1], [1]*Université de Bordeaux 1, France,* [2]*University of Waterloo, Canada,* [3]*Université de Pau et des Pays de l'Adour, France,* [4]*Université Pierre et Marie Curie, France*
[C.1.3.3]	**Templated growth strategy for highly porous oxide nanowires structures towards high efficiency devices** H.N. Hieu, N.M. Vuong, D. Kim*, *Chungnam National University, Republic of Korea*
[C.1.3.4]	**Hybrid hollow fibres with enhanced adsorption capacity and reduced pressure drop** C.A. Jeffs*[1], M.W. Smith[2], C.A. Stone[2], B.D. Crittenden[1], S.P. Perera[1], [1]*University of Bath, UK,* [2]*Dstl, UK*
[C.1.3.5]	**Hierarchically structured, porous silica monoliths based on phase-separating glasses** B. Reinhardt*, D. Enke, *University of Leipzig, Germany*
[C.1.3.6]	**Preparation, characterization and application of hierarchically structured mixed oxide catalysts** J. Kullmann*, M. Weinert, M. Weiße, D. Enke, *University of Leipzig, Germany*
[C.1.3.7]	**Hierarchical porous TiO2 thin films by soft and dual templating** C. Henrist*, R. Cloots, P. Colson, J. Jonlet, J. Dewalque, *University of Liège, Belgium*
	SYMP. C - Macrocellular solids
[C.1.4.1]	**Fabrication and properties of highly closed macro-cellular ceramics via gelation freezing route** M. Fukushima*, Y. Yoshizawa, *National Institute of Advanced Industrial Science and Technology, Japan*
[C.1.4.2]	**Microstructural characterization of a cellular ceramic produced from drinking water sludge**

Title:

Photoluminescent Silica Aerogel Containing New Developed Lanthanide Complexes

Authors & affiliations:

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Abstract:

Introduction. Through embedding various photoluminescent compounds in a silica matrix followed by the specific procedures for obtaining aerogels, a new class of materials could be obtained by a relatively straightforward preparation method. Luminescent aerogels might be the optimal solution in applications where stability in various environmental conditions or when thermal stability is required. In this work, a new developed Tb(III)-N-hydroxysuccinimide highly luminescent complex was embedded in silica matrix, through a sol-gel process followed by ageing and supercritical drying, leading to an aerogel with remarkable photoluminescence.

Methods. Tb(III)-N-hydroxysuccinimide complex was investigated through chemical analysis, EDX and FT-IR. The thermal stability was studied and X-ray powder diffraction was used for investigation of the unit cell parameters. Also fluorescent emission/excitation spectra and SEM micrographs were recorded. The photoluminescent aerogel was further investigated. The mesoporous structure of aerogel was highlighted by BET and SEM analysis.

Results and Discussion. The investigation methods revealed the formation of the complex at 1:3, metal to ligand ratio, having the general formula: $[TbL_3(H_2O)_3]$. The most intense emission peak is centered at 543 nm. The recorded FT-IR spectra of both free complex and aerogel embedded complex revealed the specific absorption bands of silica matrix and that of the complex which sustain its preservation in the aerogel. Also, in case of aerogel, the fluorescence spectrometry revealed the specific radiative transitions found in the free complex. SEM images suggest that the complex is rather attached on the solid aerogel structure than located in its pores.

The paper presents the preparation and characterization of a photoluminescent silica aerogel based on a new developed Tb(III)-N-hydroxysuccinimide complex whose suggested molecular formula was confirmed by the mentioned investigation methods. The thermal stability of complex is highly improved by embedding in silica aerogel while its photoluminescent properties are still preserved.

Acknowledgements. Financial support for this work was provided by the National Research Council (CNCS), Romanian Government in the framework of PN-II/IDEI PROGRAM (PN-II-ID-PCE-2011-3-0708, Grant No. 335/5.10.2011).

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Photoluminescent silica aerogel containing a new prepared N-Hydroxysuccinimide –Tb(III) complex

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Introduction

The synthesis of aerogels with photoluminescent compounds embedded in their structure opens a number of interesting perspectives for applications in various fields, especially in optoelectronic devices, which can benefit from their specific features, such as very low density, low refractive indices or exceptional thermal stability.

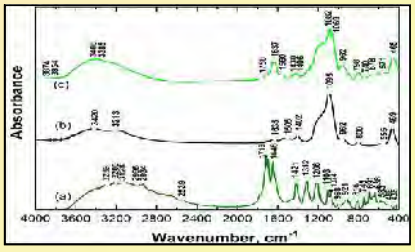
In this work, a new Tb(III)-NHSI complex was prepared and investigated prior to embedment in the silica matrix. Also the paper describes the preparation of a photoluminescent aerogel by embedding of the new prepared Tb(III) complex in a silica matrix followed by solvent exchange and supercritical drying.

Experimental part

For investigation purposes a $[TbL_3(H_2O)_3]$ complex is prepared by mixing aqueous solutions of terbium chloride and N-hydroxysuccinimide as ligand with concentrations corresponding to 1:3 metal to ligand.
Then an aqueous solution of the prepared complex was introduced during the sol-gel preparation of the silica matrix which was further processed for aerogel obtaining. Silica matrix was prepared using TEOS as precursor under base catalytic conditions. After the gelation process is completed the gel is aged in Et-OH for at least 48 hours. The obtained alchogel is finally dried by exchanging the ethanol with liquid CO_2 in a pressure vessel followed by supercritical evaporation. Both, free complex and aerogel were investigated through thermal analysis, FT-IR, powder X-ray diffraction, SEM and fluorescence spectroscopy.

Results and Discussions

FT-IR analysis

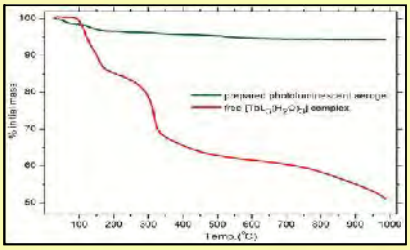


Recorded FT-IR spectra for:(a) free $[TbL_3(H_2O)_3]$ complex, (b) unloaded aerogel and (c) aerogel with embedded complex

For the unloaded aerogel the peak located at 1095 cm^{-1} is attributed to asymmetric stretching vibration of Si-O-Si bond and the peaks located at 800 cm^{-1} and 469 cm^{-1} are due to the symmetric stretching vibrations of Si-O-Si group, respectively to the deformation vibration of O-Si-O bonds.

Spectrum recorded for aerogel with embedded $[TbL_3(H_2O)_3]$ (c) shows significant changes compared to the unloaded aerogel (b), being remarked the peaks located at 1637/1560 cm^{-1}, due to C=O carbonyl groups of the embedded complex. In case of aerogel, these peaks are shifted to lower values (from 1719/1648 to 1637/1560 cm-1), most probable due to interactions occurred between these groups and silica matrix.

Thermal analysis



Recorded thermal behavior for the free $[TbL_3(H_2O)_3]$ and aerogel with embedded complex

The evolution of aerogel within the investigated temperature range is significantly different compared with the behavior of the free complex.
A significant improvement of the thermal behavior, especially useful in case of targeted applications can be noted.

Scanning electron microscopy

SEM images recorded for the photoluminescent aerogel
(a) 10 k resolution (b) 50 k resolution

The images show a typical amorphous structure for a silica aerogel. The distribution of mesopores is not homogeneous, certain areas with a higher degree of aggregation being observed. This configuration suggests the presence of the complex rather attached to the solid phase in aerogel structure than in mesopores, due to the interactions between chemical groups of complex with those specific to silica matrix.

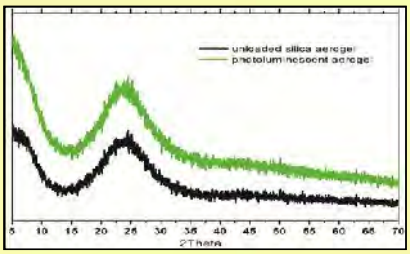
BET Surface Area and pore size analysis

Results of the BET analysis for the unloaded aerogel sample

BET Surface (m^2/g)	Specific cumulative pores surface (m^2/g)		Medium pore diameter (nm)		Cumulative pores volume (cm^3/g)	
	Adsorption	Desorption	Adsorption	Desorption	Adsorption	Desorption
341.977	353.315	431.857	115.765	97.692	1,0225	1,0547

The average pore diameter is aprox. 100 nm which indicates a predominant macroporous structure, most probable due the base catalyst used in the gelation stage.

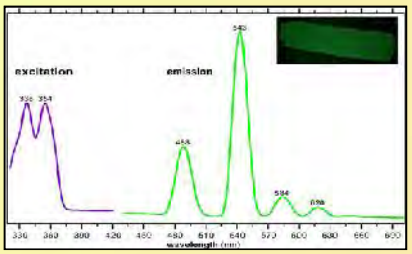
Powder X-ray diffraction



Recorded diffractograms for the photoluminescent aerogel and for the unloaded aerogel sample

Minimal differences noticed between the two diffractograms recorded are explained by the small amount of complex in the aerogel volume and also by the interactions between functional groups of the complex and silica matrix. Recorded photoluminescent properties due to the complex inserted into the aerogel structure indicates its presence as crystallites with very small sizes.

Fluorescence spectroscopy



Excitation and emission spectra recorded for $[TbL_3(H_2O)_3]$ complex / prepared photoluminescent aerogel

Significant Tb^{3+} radiative emission peaks were recorded at 488, 543, 584 and 620 nm due to $^5D_4 \rightarrow {}^7F_6$, $^5D_4 \rightarrow {}^7F_5$, $^5D_4 \rightarrow {}^7F_4$ and $^5D_4 \rightarrow {}^7F_2$ radiative transitions, the most intense peak being recorded at 543 nm The recorded excitation spectra presents two peaks centered at 336 and 354 nm. The influence of the silica matrix over the photoluminescent properties of the complex is negligible, similar spectra being recorded for the prepared aerogel.

Conclusions

- The new synthesized Tb(III) – NHSI complex exhibit strong photoluminescence as a result of specific radiative transitions within the Tb(III) cation with the most intense peak located at 543 nm due to $^5D_4 \rightarrow {}^7F_5$ transition.
- The prepared aerogel retain the photoluminescent properties of the Tb(III)-NHSI complex.
- The leaching of the free complex in the solvent medium used in various stages required by the aerogel preparation was found to be minimal due the interactions occurred between the functional groups of the Tb(III) complex and silica matrix.
- The remarkable photoluminescent emission of the prepared aerogel and also the excitation spectra, conveniently located in the UV-A region, may recommend it for applications in optoelectronics.

Acknowledgments

This work was supported by a grant of the Romanian National Authority for Scientific Research, CNCS – UEFISCDI, project number PN-II-ID-PCE-2011-3-0708.