7th International Workshop on

PHOTOLUMINESCENCE IN RARE EARTHS: PHOTONIC MATERIALS AND DEVICES

November 30 – December 2, 2017 Roma, Italy

(Roma, Fori Imperiali. Lighting by Vittorio Storaro. Photo credit: Repubblica.it)

"**PRE'17**" is the seventh event in the series of International Workshops covering a wide range of research topics concerning the properties and applications of rare-earth ions in optoelectronics and photonics. The series begun in Trento, Italy in May 2005 (PRE'05), followed by PRE'07 again in Trento, PRE'10 in Firenze (Italy), PRE'12 in Kyoto (Japan), PRE'14 in San Sebastián (Spain), PRE'16 in Greenville (USA). The next event, after the decision to move the Workshop to the odd years, will be held in Rome, Italy, in 2017.

PRE Workshops aim at providing a forum for material scientists, chemists and physicists where to debate about the state of the art and the perspectives of the photonic materials based on rare earth ions. Both fundamental photoluminescence properties and application oriented material investigations are considered. Topics of interest include (but are not limited to):

- **Fundamental photoluminescence properties & spectroscopic measurements**
- **Modeling, first-principles calculations**
- **Photonic devices exploiting rare-earths characteristics**
- **Rare-earth-doped crystalline materials**
- **Transparent ceramics and glass-ceramic materials**
- **Rare-earth optical amplifiers for telecommunication**
- **Fiber lasers and micro-chip lasers**
- **Phosphor materials for solid-state lighting**
- **Persistent phosphors**
- **Scintillators**
- **Up- and down-conversion for photovoltaic applications**
- **Rare-earth-doped materials for biological applications**

Submit your abstract !!

Important Dates

Abstract submission deadline 15 September 2017

Paper acceptance notification 15 October 2017
Early bird registration 30 October 2017
Post-deadline submission deadline 1 November 2017
Workshop opening 30 November 2017

For information please contact secretary@centrofermi.it **http://www.pre17.org/**

Poster Session I
(Thursday 30 November, 17:00-18:30)

Poster size: **100 cm (height) x 70 cm (width)**
The posters can be put up on Thursday after 14:00 and MUST be removed by 13:30 on Friday

#22	**Hiroto Ono,** Y. Fujimoto, T. Yahaba, T. Yanagida, M. Koshimizu, and K. Asai (Tohoku University, Japan)	Thermoluminescence properties of Tb^{3+}-doped $CaO–Al_2O_3–B_2O_3$-based glasses
#47	**Omar Soriano Romero**, U. Caldiño, R. Lozada, A. Méndez-Blas and A. Meza Rocha (Col. San Manuel Ciudad Universitaria, Mexico)	Spectroscopic properties of novel Nd^{3+}-doped CdO-V_2O_5 glasses for laser applications
#56	**Dmytro Bletskan** and Vasyl Kabatsii (Uzhhorod National University, Ukraine)	Photoluminescence of crystalline and glassy $PbGeS_3$
#62	**Nisha Deopa** and A.S. Rao (Delhi Technological University, India)	Photoluminescence investigations on Sm^{3+} doped zinc lead alumino borate glasses for photonic applications
#80	**Pablo Lopez-Iscoa**, A. Mishra, N. Ojha, D. Pugliese, R. Gumenyuk, N. G. Boetti, D. Janner, J. Massera, B. Bureau, C. Boussard-Plédel, L. Petit and D. Milanese (UdR INSTM, Italy)	Fabrication and characterization of erbium doped bioactive glasses, glass ceramics and optical fibers
#120	**Renata Jadach**, M. Sitarz, D. Dorosz, M. Kochanowicz, J. Zmojda, P. Miluski, W. Pisarski, J. Pisarska, Anna Lukowiak, M. Ferrari, G. Righini **(**University of Science and Technology, Poland)	Spectroscopic properties of gallo-germanate glasses doped with Eu^{3+} and Er^{3+} ions
#136	**Nirajan Ojha**, M. Tuomisto, T. Laihinen, T. Salminen, M. Lastusaari, L. Petit (Tampere University of Technology, Finland)	Corrosion of microparticles in phosphate glass melt
#137	S. Baccaro, **Alessia Cemmi**, I. Di Sarcina, Y. Wang, G. Chen (ENEA-FSN, Italy)	Photoluminescence properties of Cu^{+} doped phosphate glasses
#49	**Tong Hoang Tuan**, D. Demichi, T. Suzuki and Y. Ohishi (Toyota Technological Institute, Japan)	Tailoring 1.33-µm spontaneous emission of Neodymium-ion by a novel tellurite all-solid photonic bandgap fiber
#102	**Juan A. Vallés** and David Benedicto (University of Zaragoza, Aragon Institute for Engineering Research, Spain)	Optimized active multicore fiber bending sensor
#114	**Łukasz Sójka**, Z. Tang, D. Furniss, E. Bereś-Pawlik, R. Piramidowicz, K. Anders, A. B. Seddon, T. M. Benson and S. Sujecki (University of Nottingham, UK)	Investigation of mid infrared spontaneous emission sources based on Pr^{3+} doped selenide-chalcogenide fibre
#1	D. C. Baldini, E. H. de Faria, K. J. Ciuffi, L. A. Rocha, **Eduardo José Nassar** (Universidade de Franca, Brazil)	Titanium Films by Sol-Gel: upconversion of Yb^{3+} and Er^{3+}

Photoluminescence of crystalline and glassy $PbGeS_3$

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Photoluminescence (PL) is one of the most interesting phenomena observed in the chalcogenide glassy semiconductors (CGS) and their crystalline analogs, which give a lot of information about defect states in the mobility gap. Photoluminescence investigations are aimed to studying the nature of radiative and nonradiative centers, the processes of generation and recombination of nonequilibrium carriers in ordered and disordered semiconductors. Numerous studies of CGS photoluminescence are performed mainly for the binary GeS_2, $GeSe_2$, As_2S_3, As_2Se_3 glasses, but there is no unified concept of the phenomenon mechanism and the microscopy of emission centers in chalcogenide glasses to the present time. Therefore, it is very important to obtain the additional information on the radiative recombination for more difficult objects which also include lead thiogermanate ($PbGeS_3$). From the practical point of view, the interest to glasses of Ge–Pb–S system is conditioned by the wide possibilities to use them as the bulk optical coating for the active devices of integral optics and multifunctional devices of semiconductor photonics [1].

This paper presents the comparative study results of radiative recombination and photoluminescence excitation (PLE) spectra, temperature dependence of photoluminescence, lux-brightness characteristics (LBC) of crystalline (*c*-) and glassy (*g*-) $PbGeS_3$ in the temperature range 77–300 K. The PL spectra of ordered and disordered phases are qualitatively similar; they contain one intense broad radiation band, the energy position of its maximum at $T = 77$ K is $h\nu_{max}$ = 1.04 eV for the crystal and it lies within 1.13–1.14 eV for the glass. The luminescence excitation spectrum is a bell-shaped curve with a maximum at the photon energy of 2.7 eV for the crystal and 2.26 eV for the glass, which are close to the band gap of ordered and disordered phases, it indicates on the band-type excitation character. The Stokse shift $W_S = E_{PLE} - E_{PL}$ for the crystal phase W_{Sc} = 1.65 eV is much larger than for the glassy phase W_{Sg} = 1.07 eV. This fact together with the half-widths of emission bands indicates on the strong electron-phonon interaction of electronic transitions involving the deep impurity centers.

The similarity of PL and luminescence excitation spectra of *c*- and *g*-$PbGeS_3$ as well as their comparison to the known results for *c*- and *g*-GeS_2 ($GeSe_2$) allow to conclude that the radiative processes in lead thiogermanate are determined primarily by the chemical nature of luminescence centers and poorly depend on the presence of long-range order, while the nonradiative processes are very sensitive to the structure disordering. Since the glassy $PbGeS_3$ is synthesized in the thermodynamic nonequilibrium conditions, its atomic structure depends on the melt temperature (from which the rapid quenching is performed) as well as on the cooling velocity. It is established that the melt temperature changing (from which the quenching is performed) leads to the changes of photoluminescence characteristics of the glassy $PbGeS_3$. Thus, the melt temperature increasing is accompanied by the PL intensity increasing while the emission band is somewhat broadened and shifted to the lower energy region. The observed PL changes are a reflection of the concentration changes of intrinsic defects (such as broken bonds) with the melt temperature increasing. The luminescence intensity decreases with a time («fatigue effect» of PL) during continuous stationary excitation of *g*-$PbGeS_3$, it was observed more stronger when more short-wave light was used for excitation. The initial state was restored after heating the sample to the room temperature. At the same time, the «fatigue effect» in *g*-$PbGeS_3$ is less pronounced than in the glassy arsenic chalcogenides and it depends on the glass production conditions.

Lux-brightness characteristics (LBC) have the linear character for both $PbGeS_3$ phases. Only slight shift of the maximum in PL spectra into the high energy region is observed with the intensity excitation increasing. Linear LBCs along with the exponential decay of PL indicate to the monomolecular character of recombination in both phases.

References

[1] D.I. Bletskan, V.M. Kabatsii, Bulk optical coating and device for its applying, *Patent of Ukraine*, **13**, 95127 (2011).

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