

ity, involving morphology as well as eventual pre-reaction state of starting oxides, has to be strongly taken into account. Some examples are given on the role of these parameters on luminescent properties of industrial type phosphors.

558 Spectroscopic Properties of Chromium (III) in Zirconium Barium Fluoride Glass (ZBLA): R. Balda, J. Fernández, M. A. Illarramendi, and M. J. Elejalde, Dpto. Física Aplicada, Escuela Técnica Superior de Ingenieros Industriales, Universidad del País Vasco, 48013 Bilbao, Spain

The optical properties of trivalent chromium ions in ZBLA glass have been studied for different concentrations of Cr^{3+} . Optical absorption, luminescence, and lifetimes were investigated in a wide range of temperatures. The relative quantum efficiencies of these systems were also determined from the integrated luminescence decay curves as a function of the excitation wavelength. Photoacoustic measurements performed at room temperature give a value of 0.1 for the absolute quantum efficiency of the $x = 0.85$ a/o Cr^{3+} sample.

559 Charge Transfer Luminescence in Polysilanes: J. R. G. Thorne,* R. M. Hochstrasser, and J. M. Zeigler, Dept. of Chemistry, University of Pennsylvania, Philadelphia, PA 19104-6323

The polysilanes $(\text{RR}'\text{Si})_n$ represent a new class of luminescent material: the nature of the elementary optical excitations remains controversial. Normal fluorescence at 350 nm has a radiative lifetime of 600 ps but luminescence at 430 nm, attributed to a charge transfer transition, is much longer lived. We present an analysis of the time dependence of this latter luminescence and discuss the consequences for hole conduction and the low-dimensional character of these compounds.

560 Novel Technique in the Preparation of Eu^{2+} Doped Phosphors: R. P. Rao* and R. Jagannathan, Central Electrochemical Research Institute, Karaikudi-623006, India

Divalent europium doped phosphor materials such as alkaline earth chlorophosphates, aluminates, silicates, and fluorochlorides have been prepared in presence of activated charcoal (carbon). The excitation, emission spectra, and color coordinates of these phosphor materials are presented. Luminescence analysis shows no trace of unreduced Eu^{3+} activator. It is concluded that this technique can be used fruitfully in the preparation of Eu^{2+} doped phosphors in place of complicated process based on forming gas ($\text{N}_2 + \text{H}_2$).

561 Luminescence Properties of Thorium Phosphate Transparent Gels Doped with Rare Earths and Uranyl Ions: M. G. Iroulart, V. Brandel, E. Simoni,* and M. Genet, Laboratoire de Radiochimie, Institut de Physique Nucléaire, 91406 Orsay Cedex, France

Some luminescent compounds have been prepared from thorium phosphate gel medium doped with Mn^{2+} , Eu^{3+} , Tb^{3+} , UO_2^{2+} . In terms of drying temperature of gels the luminescence properties of ions, intensity and decay time, have been investigated in various types of materials: transparent gels (20°C) and xerogels (50°C), amorphous (80°-950°C) and crystalline (1050°C) powdered solids. Luminescence intensity is more important in xerogels compared to the other forms, and decay time is longer.

562 Novel Emission of Dy in Magnesium Fluoroborate: X. Liu, Y. Zhang, and Z. Wang, Changchun Institute of Physics, Academia Sinica, Changchun, China, S. Xu, Shanghai University of Science and Technology, Shanghai, China

A new emission line 614.5 nm has been observed in the fluorescence spectrum of $\text{Mg}_3\text{BO}_3\text{F}_3:\text{Dy}^{3+}$. Its lowest exciting energy is found to be about $2.15 \times 10^4 \text{ cm}^{-1}$. Many excitation peaks also appear in the range 23,000-34,000 cm^{-1} . The emission of $\text{Mg}_3\text{BO}_3\text{F}_3:\text{Eu}^{3+}$ is at 612 nm and easily separated from the 614.5 nm line in the doubly doped phosphor $\text{Mg}_3\text{BO}_3\text{F}_3:\text{Dy}^{3+}, \text{Eu}^{3+}$. These facts exclude possible Eu^{3+} or Pr^{3+} contamination. The corresponding transition is probably ${}^4\text{I}_{15/2} - {}^6\text{H}_{11/2}$ of Pr^{3+} .

563 Luminescence from Several Activators in $\text{SrBeLa}_2\text{O}_5$: G. Blasse* and G. J. Dirksen, Physics Laboratory, University of Utrecht, 3508 TA Utrecht, The Netherlands

The compound $\text{SrBeLa}_2\text{O}_5$ was recently reported by Müller-Buschbaum. The unactivated compound shows a broad-band emission. Several activators were tried in this lattice. Their luminescence properties are rather exceptional. This is discussed in relation to the crystal structure of the host.

564 A Long-Persistent Blue Phosphor $\text{SrSb}_2\text{O}_6:\text{Mn}^{2+}$: H. Yamada, H. Matsukiyo, T. Suzuki, and H. Yamamoto,* Hitachi Ltd., Central Research Laboratory, Kokubunji, Tokyo 185, Japan, T. Okamura, T. Imai, and M. Morita, Faculty of Engineering, Seikei University, Kitamachi, Kichijyoji, Masushino, Tokyo 180, Japan

Blue Mn^{2+} luminescence in SrSb_2O_6 has persistence of 47 ms at 10% peak height. A new synthesis method has improved its efficiency to 1/3 relative to $\text{ZnS}:\text{Ag, Cl}$. A host luminescence peaked at 370 nm, however, competes with the blue luminescence. A reason for the rare blue Mn^{2+} luminescence is discussed in relation to the crystal structure. A CRT screened with this phosphor shows reduced flicker compared with conventional screens.

565 Enhancement of Cathodoluminescence in $\text{LaOBr}:\text{Tb}$ by Codoping with Dy: Y. Li, X. Liu, and X. Xu,* Tianjin Institute of Technology, Tianjin, China 300191

The cathodoluminescence of $\text{LaOBr}:\text{Tb}$ is enhanced in brightness by an amount of more than 40% when we codoped the phosphor with Dy. By means of comparison with photoluminescence intensity and decay time under short wave excitation we attributed this phenomenon to the energy transfer in the form of cross relaxation from Tb^{3+} to Dy. The transitions from ${}^5\text{D}_3$ diminishes and that from ${}^5\text{D}_4$ increases, so that the color of luminescence changes from violet-blue to green and becomes more sensitive for human eyes.

566 Terbium-Activated Yttrium Silicate Lamp Phosphors: T. E. Peters,* R. B. Hunt and R. G. Pappalardo, GTE Laboratories, Inc., Waltham, MA 02254, F. Taubner, GTE Products Corp., Danvers, MA 01923

A previously reported, high Tb, Ce³⁺ co-activated version of the well-known CRT phosphor, $\text{Y}_2\text{SiO}_5:\text{Tb}$, is hardly used in lighting applications because of its poor "lehr" resistance and the considerable cost associated with its Tb content. Cerium-free Y_2SiO_5 phosphors of lower Tb content that were prepared with fluoride mineralization exhibited poor lumen maintenance in lamps. On the contrary, similar materials prepared from a sol-gel precursor showed performance identical to that of $(\text{Ce, Tb})\text{MgAl}_{11}\text{O}_{19}(\text{CAT})$ in a variety of fluorescent-lamp types. Pertinent lamp data are presented, and peculiarities associated with the high 254 nm reflectivity of $\text{Y}_2\text{SiO}_5:\text{Tb}$ are discussed.

567 Luminescence of Rare-Earth Cryptates: G. Blasse,* University of Utrecht, Physics Laboratory, 3508 TA Utrecht, The Netherlands, N. Sabbatini, Dipartimento di Chimica, University of Bologna, Bologna, Italy

The luminescence of rare-earth cryptates is discussed and reviewed. In the cryptates the rare-earth ion is encapsulated by a cryptand, a molecule which contains a hole in itself. The luminescence properties yield interesting information on nonradiative transitions, thermal quenching, and energy transfer which can be used in the materials science of luminescent materials.

568 Temperature Dependence of the Vibronic Spectrum and Lifetime of $\text{LiGa}_5\text{O}_8:\text{Mn}^{2+}$: T. Abritta and R. J. M. da Fonseca, Instituto de Física-UFRRJ, Ilha do Fundão CT-Bloco A-Rio de Janeiro-RJ, Brazil 21945

The luminescence of $\text{LiGa}_5\text{O}_8:\text{Mn}^{2+}$ presents, at low temperatures, a sharp zero-phonon line due to the ${}^2\text{E} \rightarrow {}^4\text{A}_2$ transition of this center octahedrally coordinated. Most of the observed sidebands were identified as infrared or Raman modes of the host. As the temperature is increased the vibronic band increases relatively to the zero-phonon line, and above 450 K we have the luminescence extinction. By measurements of the decay rates these facts are interpreted using models of radiative vibronic transitions and nonradiative transitions.

569 Energy Transfer Process in Alkaline Earth Rare Earth Pentaborate Phosphors: R. Jagannathan and R. P. Rao,* Central Electrochemical Research Institute, Karaikudi-623006, India, T. R. N. Kutty, Indian Institute of Science, Bangalore-560 012, India

Phosphors based on rare earth borates prove to be efficient materials used in fluorescent lamps, gas discharge display panels, etc. Number of phosphor samples based on the composition $\text{Ln}_{1-x-y}\text{M}^{2+}\text{B}_5\text{O}_{10}:\text{Ce}_2\text{Tb}_y$ ($\text{Ln} = \text{Gd}^{3+}, \text{Y}^{3+}, \text{La}^{3+}$), ($\text{M}^{2+} = \text{Mg, Ca, Sr, Ba}$) have been prepared and characterized for their luminescent properties. Energy transfer process from sensitizer to activator through sublattice gets modified with M^{2+} content. Quenching of luminescence attributed to concentration effects and modifications of lattice are discussed.

570 Energy Transfer Between Pb^{2+} and Gd^{3+} Ions: H. S. Kiliaan and G. Blasse,* Physics Laboratory, University of Utrecht, 3508 TA Utrecht, The Netherlands

The sensitization of the Gd^{3+} ion by Pb^{2+} is investigated in GdBO_3 , Gd_2O_3 , $\text{Ba}_3\text{Gd}(\text{PO}_4)_3$, $\text{Ba}_2\text{Gd}_2(\text{PO}_4)(\text{SiO}_4)$, and $\text{Sr}_2\text{Gd}_2(\text{SiO}_4)_2\text{O}_2$. Under certain conditions efficient energy transfer from Pb^{2+} to Gd^{3+} occurs. These conditions are evaluated. The oxyapatite illustrates the important role of Cd^{3+} in the energy transfer process from sensitizer to activator in gadolinium compounds.

571 Luminescence and Energy Migration in $(\text{Sr, Eu})\text{B}_4\text{O}_7$: A. Meijerink,* J. Nuyten, and G. Blasse, Physics Laboratory, University of Utrecht, 3508 TA Utrecht, The Netherlands

The luminescence of Eu^{2+} in $(\text{Sr, Eu})\text{B}_4\text{O}_7$ and energy migration in the concentrated system are reported. The luminescence properties of Eu^{2+} in the diluted system are explained on the basis of an energy level scheme in which the $4f^1({}^6\text{P}_{7/2})$ excited state of Eu^{2+} is about 100 cm^{-1} lower in energy than the $4f^{5d}$ excited state. Energy migration over the $4f^1({}^6\text{P}_{7/2})$ level of Eu^{2+} in EuB_4O_7 is analyzed using a random walk model for two-dimensional energy migration.

572 Energy Transfer Effects in Beta'-Alumina: L. A. Momoda,* J. D. Barrie, B. Dunn, and O. M. Stafuss, Dept. of Materials Science and Engineering, University of California at Los Angeles, Los Angeles, CA 90024-1600

Ion exchange techniques have been developed to simultaneously incorporate two lanthanide ions into β' -alumina. This ap-

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