



SACRED
HEART
COLLEGE
Autonomous



Thevara, Kochi 682 013, Kerala, India, Tel: 0484-2663380, 2870500
Email: office@shcollege.ac.in; www.shcollege.ac.in

Paper Serial No: 176

Serial Number	176
Title of paper	Highly luminescent yellow and yellowish-green light-emitting electrochemical cells based on cationic iridium complexes with phenanthroline based ancillary ligands
Name of the author/s	Sunesh C.D., Chandran M., Mathai G., Choe Y.
Department of the teacher	Chemistry
Name of journal	Optical Materials
Year of publication	2014
ISSN number	0925-3467

Dr. Jose John
Principal in Charge
Sacred Heart College (Autonomous)
Thevara, Kochi - 682 013



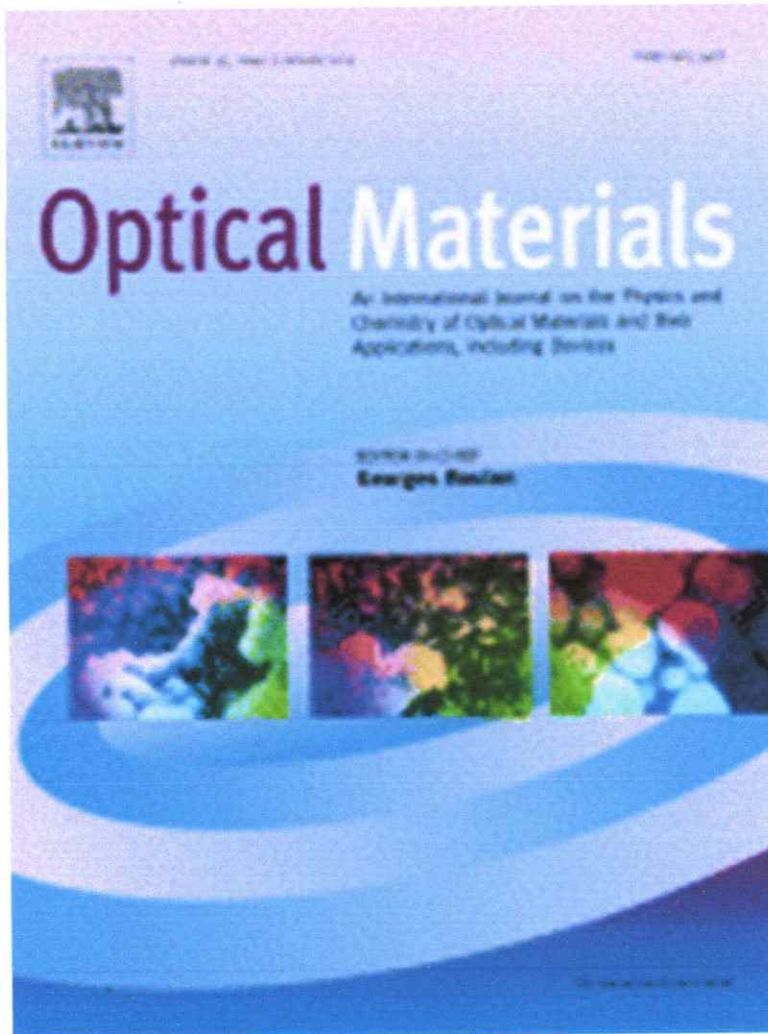


SACRED
HEART
COLLEGE
Autonomous



Thevara, Kochi 682 013, Kerala, India, Tel: 0484-2663380, 2870500
Email: office@shcollege.ac.in; www.shcollege.ac.in

Cover Page of the Paper (Serial No: 176)



Dr. Jose John
Principal in Charge
Sacred Heart College (Autonomous)
Thevara, Kochi-682 013



First Page of the Paper(Serial No: 176)

Optical Materials 35 (2013) 407–413



Contents lists available at SciVerse ScienceDirect

Optical Materials

journal homepage: www.elsevier.com/locate/optmat



Highly luminescent yellow and yellowish-green light-emitting electrochemical cells based on cationic iridium complexes with phenanthroline based ancillary ligands

Chozhidakath Damodharan Sunesh^a, Midhun Chandran^a, George Mathai^b, Youngson Choe^{a,*}^a Department of Polymer Science and Chemical Engineering, Pusan National University, Busan 609-735, South Korea
^b Department of Chemistry, Sacred Heart College, Thevara, Kochi 682 013, India

ARTICLE INFO

Article history:

Received 4 June 2012
Received in revised form 30 August 2012
Accepted 17 September 2012
Available online 1 November 2012

Keywords:

Light-emitting electrochemical cells
Thin films
Luminescence
Electrical properties
Optoelectronic devices

ABSTRACT

Highly luminescent light-emitting electrochemical cells (LECs) based on cationic iridium complexes [Ir(ppz)₂(dpphen)]PF₆ (1) and [Ir(ppz)₂(tmphen)]PF₆ (2) (ppz is 1-phenylpyrazole, dpphen is 4,7-diphenyl-1,10-phenanthroline and tmphen is 3,4,7,8-tetramethyl-1,10-phenanthroline) with phenanthroline based ancillary ligands were fabricated using air stable electrodes and their electroluminescent properties were investigated. LECs based on complex 1 emitted yellow electroluminescence (λ_{max} 574 nm) with Commission Internationale de L'Eclairage (CIE) coordinates of (0.49, 0.50) while the complex 2 gave yellowish-green electroluminescence (λ_{max} 537 nm) with CIE coordinates of (0.35, 0.58). The work done here reveals that the alkyl substituted phenanthroline ancillary ligand, tmphen shifts the light emission to the shorter wavelength region than the phenyl substituted dpphen ligand, resulting in the color tuning of the light-emitting devices. Density functional theory (DFT) calculations were performed to gain insight into the molecular surfaces of cationic iridium complexes and their electrochemical behaviors. Single layer LECs based on these complexes exhibited a high luminescence of 5199 and 4751 cd/m² for complexes 1 and 2 respectively. The ionic liquid, 1-ethyl-3-methylimidazolium hexafluorophosphate (EMIMPF₆) was added to the light emitting layer and hence higher luminances were obtained than the pristine device.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

Ionic transition metal complexes (iTMCs) have drawn increased attention as electroluminescent materials in light-emitting electrochemical cells (LECs) in the past few years [1–23]. LECs based on iTMCs have more advantages over the multilayered organic light-emitting diodes (OLEDs) as the former consist of only a single light emitting layer, which can be easily processed from solutions. This makes the device fabrication simple and cost effective. Being ionic, LECs based on iTMCs can perform multiple roles such as charge injection, transport and emissive recombination in comparison with the multilayered OLEDs. Moreover, the ionic nature of iTMCs makes it soluble in polar organic solvents thus preventing the intermixing of the deposited buffer layer.


The first solid state LEC was based on polymer blend reported by Heeger et al. in 1995 [24]. Thereafter, phosphorescent iTMCs have attracted more attention because of their many advantages over the multicomponent polymer based LECs which consists of a blend of conjugated polymer, an ion conducting polymer to en-

hance conductivity and an inorganic salt to balance charge injection [24,25]. LECs using iTMCs are intrinsically ionic and hence no ion conducting material is required. These mobile ions drift towards the respective electrodes upon the application of an external bias, creating a large electric field near the electrode surfaces. As a result, holes and electrons are injected from the respective electrodes and make the device insensitive to the work function of the electrodes [26,27,1]. These injected charge carriers transport and their recombination can result in the emission of light at low operating voltage.

LECs based on ionic Ru(II) [1,2,28,5,29,30], Os(II) [3,31] and Cu(I) [32,33] complexes with high efficiency and brightness have been reported, but could impart only orange-red or green light emission due to their limited ligand-field splitting energies of the central metal atom. Among the iTMCs, phosphorescent iridium(III) complexes show a series of advantages because of their excellent photophysical and electroluminescent properties. They have high efficiency in addition to the thermal and chemical stabilities. Due to the heavy atom effect of Ir(III) ion, the iridium complexes exhibit large spin orbit coupling that results in the mixing of triplet and singlet energy states. Thus, intersystem crossing of the singlet excited states to the triplet manifold occurs with internal quantum

* Corresponding author. Tel: +82 51 510 2396; fax: +82 51 512 8634.
E-mail address: choe@pusan.ac.kr (Y. Choe).




Dr. Jose John
Principal in Charge
Sacred Heart College (Autonomous)
Thevara, Kochi-682 013



Page 2 (Contents Page) of the Journal (Serial No: 176)



Supports open access

2.779
Impact Factor

Articles & Issues ▾ About ▾ Submit your article ↗ Guide for authors ↗

Volume 35, Issue 3

Pages 317-692 (January 2013)

Download full issue

< Previous vol/issue

Next vol/issue >

Receive an update when the latest issues in this journal are published

Sign in to set up alerts

Felipe Thomaz Aquino, Jefferson Luis Ferrari, Sidney José Lima Ribeiro, Aiban Ferrier, ... Rogéria Rocha Gonçalves
Pages 387-396

Purchase PDF Article preview ▾

Research article Abstract only

Concentration-dependent optimization of Yb³⁺/Er³⁺ highly-doped phosphate glass waveguide amplifiers and lasers using a microscopic statistical formalism

J.A. Vallés

Pages 397-401

Purchase PDF Article preview ▾

Research article Abstract only

Fluorescence spectroscopic studies of Mn³⁺ ions in SrO-Al₂O₃-B₂O₃-SiO₂ glass system

A. Rajesh Kumar, T.G.V.M. Rao, N. Veeriah, M. Rami Reddy

Pages 402-406

Purchase PDF Article preview ▾

Research article Abstract only

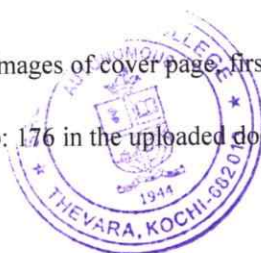
Highly luminescent yellow and yellowish-green light-emitting electrochemical cells based on cationic iridium complexes with phenanthroline based ancillary ligands

Chozhidakath Damodharan Sunesh, Midhun Chandran, George Mathai, Youngson Choe

Pages 407-413

Purchase PDF Article preview ▾

Certified that the above scanned images of cover page, first page of the paper and page 2 of the journal pertain to the paper submitted as Sl. No: 176 in the uploaded document of key indicator 3.4.3.



Dr. Jose John
Dr. Jose John
Principal in Charge
Sacred Heart College (Autonomous)
Thevara, Kochi-682 013