

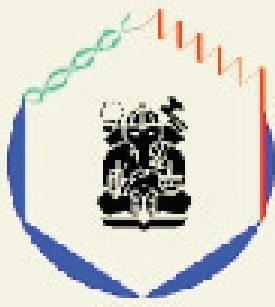
*Presentasi pada Seminar Internasional dengan Prosiding*



# **Preparation of Hybrid Organic-Inorganic Polymers doped with Luminescent Molecules and their Characterizations**

**2<sup>nd</sup> International Conference on Mathematics and Natural  
Sciences (ICMNS) 2008  
28 -30 October 2008  
Institut Teknologi Bandung, Bandung, Indonesia**

**Pina Pitriana, Fitrilawati, Pardi Sampe Tola, Rani Miranti,  
Rahmat Hidayat**



# ICMNS 2008 Proceedings

THE SECOND INTERNATIONAL CONFERENCE ON MATHEMATICS AND NATURAL SCIENCES 2008

Institut Teknologi Bandung, Indonesia  
28-30 October 2008

PROCEEDINGS  
of The 2<sup>nd</sup> International Conference on  
Mathematics and Natural Sciences  
(ICMNS) 2008

Institut Teknologi Bandung, Indonesia  
28 – 30 October 2008

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The Second International Conference on Mathematics and Natural Sciences (ICMNS 2008) is organized by Faculty of Mathematics and Natural Sciences, School of Pharmacy, and School of Life Sciences and Technology at Institut Teknologi Bandung.

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# PREFACE

This proceeding contains the papers of the talks presented in the Second International Conference on Mathematics and Natural Sciences (ICMNS 2008). The conference was jointly hosted by Faculty of Mathematics and Natural Sciences, School of Pharmacy, and School of Life Sciences and Technology at Institut Teknologi Bandung. This conference is also one of the many events organized to commemorate the 50<sup>th</sup> anniversary of Institut Teknologi Bandung.

ICMNS 2008 was held in Aula Barat, Aula Timur, Campus Centre, and Basic Science Center at Institut Teknologi Bandung on 28-30 October 2008. The conference aims to promote interdisciplinary research in science and technology, to promote the development of science and their roles in the development of science-based technology, and to disseminate research in various field of mathematics and natural sciences.

There are nine main areas of research covered in this conference. They are health sciences, environmental sciences, biosciences and biotechnology, physical sciences, material sciences, mathematics, computer science and computational science, instrumentation, and earth and space sciences. Some of the papers were part of four mini-symposia: Biological Control, Computational Science, Graph Theory and Combinatorics, and Stellar Physics.

We would like to thank the invited speakers and those who have submitted papers to this conference. The organizer is grateful to Institut Teknologi Bandung for its support towards the organization of the conference. We would also like to thank Ikatan Alumni Institut Teknologi Bandung who had contributed for ICMNS 2008 presentation and poster awards.

Bandung, 14 June 2009  
On behalf of the Organizing Committee,  
Rinovia Simanjuntak  
Chair

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# PREPARATION OF HYBRID ORGANIC-INORGANIC POLYMERS DOPED WITH LUMINESCENT MOLECULES AND THEIR CHARACTERIZATIONS

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**Abstract.** We have synthesized hybrid organic-inorganic polymer prepared from an organically modified siloxane monomer using sol-gel technique. Europium (III) complexes and organic dye lasers that exhibit strong luminescence properties were incorporated as doped materials. The effect of some synthesis condition parameters on the gel yield efficiency and the characterization results, using FT-IR, UV-Vis absorption and luminescence spectroscopy, will be presented. The hybrid polymer doped with Eu(DBM)<sub>3</sub> complexes prepared in this work shows better optical transmittance compared to the hybrid polymer mixed with commercially available Eu(DBM)<sub>3</sub>-phen, which is attributed to the reduction of complex segregation in the polymers.

**Keywords:** organic-inorganic hybrid polymers, lanthanide complexes, organic dye doped polymers, luminescence.

## 1 Introduction

Polymers or plastics are materials that we can find easily in our daily life in various applications for replacing glass, metal and wood materials. Polymers, such as acrylic and styrene based polymers are typical example of most commonly used polymers. However, such kinds of polymers are still having some weakness on their mechanic and thermal stability. In particular, their glass transition temperature (T<sub>g</sub>) and decomposition temperature (T<sub>d</sub>) are relatively low. In order to overcome those limitations, there are many efforts to develop new polymers that have good functionality and mechanic and thermal stability. [1] The polymers that called as hybrid polymers are rapidly emerging recently. The polymers contain organic and inorganic backbones such that they have similar properties like inorganic glasses or ceramics but can be functionalized and processed like organic carbon based polymers. [2,3]

For some applications, these hybrid polymers are often used as host matrix for functional organic materials such as dyes laser [4], metal complexes [5], and rare earth ions [6]. These doped hybrid polymers can be used for waveguide [5], laser source [4,7]. Hybrid polymers doped with rare earth ions, such as Erbium (Er<sup>3+</sup>), Neodymium (Nd<sup>3+</sup>) and Europium (Eu<sup>3+</sup>), exhibit luminescence properties which are suitable for laser source and optical amplifier in optical communications [4]. Another lanthanide ion like Gd<sup>3+</sup> has quantum efficiency close to 1, but its luminescence occurs at ultra-violet area so that it is not interesting for polymer fiber laser.

## 2 Experiment

The preparation of hybrid polymers involves two steps of polymerizations, that is, the polymerization of inorganic chains by sol-gel process and the polymerization of organic chains by thermal- or photo-polymerization. The sol-gel process consists of hydrolysis and condensation processes, which give the reaction product in the form of gel. We called it as precursor gel hereafter. This precursor gel was made from a solution with composition of monomer (3-(trimethoxysilyl)propyl methacrylate), ethanol, water and acid catalyst. Generally, although sol-gel process does not involve complicated reactions, controlling the process rate is rather difficult. In order to find the composition and process condition that will give the optimum yield of gel product per monomer mass, the sol-gel synthesis was carried out for various monomer:H<sub>2</sub>O weight ratio. During the preparation of these gel precursors, organic laser dye, such as Eu(DBM)<sub>3</sub>, Eu(DBM)<sub>3</sub>-phen, Rhodamin 6G perchlorate (R6G), or [2-[2-[4-(dimethylamino)-phenyl]ethenyl]-6-methyl-4H-pyran-4-ylidene]-propanedinitrile (DCM) was added in the solution.

For preparing thin films of these hybrid polymers, the precursor gel was drop-casted or spin-casted on a substrate and then photo-polymerized by using a UV lamp for several minutes. Pre- and post-bake were done at 60-70 °C for more than one hour in an oven. These thin films are then characterized by using a FT-IR spectrometer, UV-Vis spectrometer and photoluminescence spectrometer utilizing a CCD spectrometer.