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Synthesis and characterization of inorganic-
organic hybrid polymers based 3-
(trimethoxysilyl) propyl methacrylate
(TMSPMA) monomers for carbon steel
coating applications

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H. A. Melati, W. Suratno, R. Hidayat, N. Syakir,
F. Fitrilawati

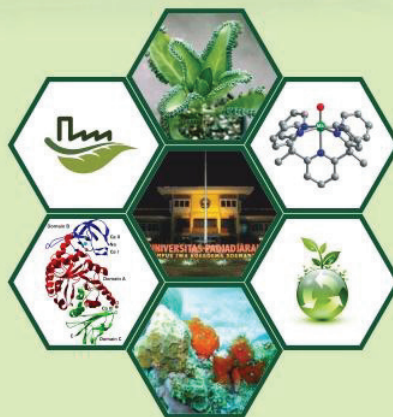


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“Chemistry for a better future”

24-25 November 2011
Aula Pusat Studi Bahasa Jepang
Jatinangor Campus, Universitas Padjadjaran



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Faculty of Mathematics and Natural Sciences
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Preface

The 2nd International Seminar on Chemistry 2011 (ISC-2011) is organized by the Department of Chemistry, Universitas Padjadjaran, Bandung, Indonesia in cooperation with Indonesian Chemical Society. This seminar is the second seminar after previous seminar in 2008 and will be arranged triannually.

ISC-2011 is attended by about 350 participants come from ten different countries, including invited speakers. The topic of this seminar is “*Chemistry for a better future*”, which cover areas related to chemical sciences which are innovation in analytical methods, techniques and instrumentation; innovation in material chemistry and nanotechnology; natural products chemistry and organic synthesis; biomolecular sciences and biotechnology; information technology in chemical sciences and computational chemistry; environmental and green chemistry, and chemical education.

This proceeding consists of articles of invited speaker lectures, oral, and poster presentations. They represent the recent development of chemical sciences, as well as providing a survey of some research efforts taken around the world. As to note, we did not make any changes to the content of full papers, we just edited the format of the full papers.

ISC-2011 is generously sponsored by Puriska Unpad, Lanxess, Kromtekindo Utama and supported by PT. Propan Raya, DAAD, PT. Unitama Analitika Perkasa, PT. Fajar Mas Murni, Pesona Scientific, Enseval Medika Prima, Buchi Indonesia, and Sucofindo. The success of the seminar is also supported by the hard works of staffs and students of the Department of Chemistry, Universitas Padjadjaran, as well as other member of the committees. Therefore, we would like to acknowledge for their support.

Finally, we hope that this proceeding will provide the reader with stimulating effects on the chemical sciences research.

Jatinangor, February 2012
Chairperson of the Organizing Committee

Euis Julaha

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Synthesis and characterization of inorganic-organic hybrid polymers based 3-(trimethoxysilyl) propyl methacrylate (TMSPMA) monomers for carbon steel coating applications

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Abstract

The synthesis and characterization of inorganic-organic hybrid polymers based 3-(Trimethoxysilyl) propyl methacrylate (TMSPMA) monomers for carbon steel coating application has been done. This materials was used as a coating on carbon steel to protect from corrosion againts. Hybrid polymer precursors were synthesized from TMSPMA monomers using sol-gel technique. Hybrid polymers conversion is done by photopolymerization section where resulting the transparent thin films in which various types of substrates. Characterization has been done towards structure, mechanical, thermal properties of hybrid polymers. The carbon steel surface morphology examined by scanning electron microscope. Infrared spectra of hybrid polymers showed the presence of inorganic and organic clusters which got into polymerization. Characterization of mechanical properties based on Mohs Scale revealed that the scratch resistance equivalent to the gypsum mineral. The thermal resistance characterization based on Thermal Gravimetry-Differential Thermal Analysis (TG-DTA) measurements shows result of TG in the sort of decomposition of hybrid polymers at 251.64-350.61°C with 14.57% lost of weight, whereas the results of DTA shows the peak at 155.75°C. This thermal resistance offered an exothermic effect related to the recrystallization reaction indicating a change of structure which was more stable. Based on examination of surface morphology, it appears that the surface morphology of the hybrids polymers provide a smooth surface covered the carbon steel as a coating and it does not change the physical character of carbon steel.

Keywords: characterization, coating, hybrid polymers, photopolymerization, sol-gel

Introduction

Coatings have been used extensively to provide protection and prevention of corrosion on metal surfaces, so the coating material requires some properties, such as mechanical strength and hydrophobicity (Chou, 2001). One type of materials was being developed as a coating is hybrid polymers. These polymers combine the superior properties between inorganic and organic materials. Development using of this material is to strengthen the organic polymers coating systems such as polianilin (PANI) which has less adhesivity and difficulties in film deposition (Sekine *et al.*, 1992) therefore polyethylene (PE) which is easy to be cracks due to corrosion and low not only chemical but also thermal stability (Sulistijono, 2008). For this application, hybrid polymers coating can be replace the system of chromate coating according to the current legislation on environmental stresses due to

the ban on the use of toxicity (Schottner, 2001; Chou, 2001).

Commonly, hybrid polymers show excellent adhesion to various metals and glass by sol-gel reaction and then used as an adhesive material. The combination of barrier function and good properties of adhesion is a prerequisite for the coatings on metals in providing corrosion resistance properties (Haas, 2000). Low temperature conditions in the sol-gel process and its speed makes it possible to do the roll coating process for applications and a thin film on a metal sheet (Schottner, 2001; Chou, 2001). Based on the literature review, hybrid inorganic-organic polymers have been used as a coating to protect steel and other metals from corrosion attack. Souza *et al.* (2001) makes organic-inorganic hybrid polymers from tetraethylorthosilicate (TEOS) and polydimethylmetoxysilane (PDMS) as a coating on the substrate steel and galvanized steel electrolysis with iron-zinc coating. Ramesh (2008) makes the siloxane coating system of polyester resin that gives