

Basic Science for Sustainable Marine Development

PROCEEDING

INTERNATIONAL SEMINAR 2015

Ambon, 3-4 June 2015

Organized by
Faculty of Mathematics and Natural Sciences
Pattimura University



PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

ISBN : 978-602-97522-2-9

- Organizing Committee : PANITIA DIES NATALIES XVII
Fakultas Matematika dan Ilmu Pengetahuan Alam
Universitas Pattimura
- Advisory : Prof . Dr. Pieter Kakisina, M.Si
- Scientific Comitte : Prof. Dr. Th. Pentury, M.Si (Mathematic)
Prof. Dr. Pieter Kakisina, M.Si (Biology)
Dr. Yusthinus T. Male, M.Si (Chemistry)
Dr. Catherina M. Bijang, M.Si (Chemistry)
R. R. Lakollo, S.Si., M.Si (Physic)
Grace Loupatty, S.Si., M.Si (Physic)
M. W. Talakua, S.Pd., M.Si (Mathematic)
- Obligator : Dr. A. Netty Siahaya, M.Si
Pieldry Nanlohy, S.Si., M.Si
- Editors : Dr. Ir. R. Hutahalung, M.Si
Dr. La Eddy, M.Si
Zeth Arthur Leleury, S.Si., M.Si
Nelson Gaspersz, S.Si., M.Si
Lady Diana Tetelepta, S.Si., M.Si
Yunita Latupeirissa, S.Si., M.Si
Sunarti, S.Si
- Cover Design : D. L. Rahakbauw, S.Si., M.Si
Lexy Janzen Sinay, S.Si.M.Si

Mathematic and Natural Science Faculty
Pattimura University
Ir. M. Putuhena St.
Kampus Poka-Ambon
Pos Code 97233
Email:fmipa_unpatti@gmail.com

October 2015

© 2015 Mathematic and Natural Science Faculty, Pattimura University

All rights reserved

Republication of an article or portions thereof in original form or in translation, as well as other types of reuse require formal permission from publisher.

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

Welcoming Address by The Organizing Committee

The honorable, the rector of Pattimura University

The honorable, the vice rector of academic affair, Pattimura University

The honorable, the vice rector of administration and financial affair, Pattimura University

The honorable, the vice rector of planning, cooperation and information affair, Pattimura University

The honorable, all the deans in Pattimura University

The honorable, the key note speakers and other guests.

We have to thank The Almighty God for the blessings that allow this International seminar can be held today. This is the first seminar about MIPA Science in which the Faculty of MIPA Pattimura University becomes the host. The seminar under the title Basic Science for Sustainable Marine Development will be carried out on 3 June 2015 at Rectorate Building, the second floor. There are 250 participants from lecturers, research institute, students, and also there are 34 papers will be presented.

This International seminar is supported by the amazing people who always give financial as well as moral supports. My special thanks refer to the rector of Pattimura University, Prof. Dr. Thomas Pentury, M.Si, and the Dean of MIPA Faculty, Prof. Dr. Pieter Kakissina, M. Si. I also would like to express my deepest gratitude to Dr. Kotaro Ichikawa, the director of CSEAS Kyoto University, Prof. Bohari M. Yamin, University of Kebangsaan Malaysia, Prof. Dr. Budi Nurani Ruchjana (Prisident of Indonesian Mathematical Society/Indo-MS), Dr. Ir. A. Syailatua, M.Sc (Director of LIPI Ambon), and Hendry Ishak Elim, PhD as the key note speakers. We expect that this international seminar can give valuable information and contribution especially in developing basic science for sustainable marine development in the future.

Last but not least, we realize that as human we have weaknesses in holding this seminar, but personally I believe that there are pearls behind this seminar. Thank you very much.

Chairman

Dr. Netty Siahaya, M.Si.

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

Opening Remarks By Dean of Mathematic and Natural Science Faculty

I express my deepest gratitude to The Almighty God for every single blessing He provides us especially in the process of holding the seminar until publishing the proceeding of International Seminar in celebrating the 17th anniversary of MIPA Faculty, Pattimura University. The theme of the anniversary is under the title Basic Science for Sustainable Marine Development. The reason of choosing this theme is that Maluku is one of five areas in Techno Park Marine in Indonesia. Furthermore, it is expected that this development can be means where the process of innovation, it is the conversion of science and technology into economic value can be worthwhile for public welfare especially coastal communities.

Having the second big variety of biological resources in the world, Indonesia is rich of its marine flora and fauna. These potential resources can be treated as high value products that demand by international market. Basic science of MIPA plays important role in developing the management of sustainable marine biological resources.

The scientific articles in this proceeding are the results of research and they are analyzed scientifically. It is expected that this proceeding can be valuable information in terms of developing science and technology for public welfare, especially people in Maluku.

My special thanks refer to all researchers and reviewers for your brilliant ideas in completing and publishing this proceeding. I also would like to express my gratefulness to the dies committee-anniversary of MIPA Faculty for your creativity and hard working in finishing this proceeding, God Bless you all.

Dean of Mathematic and Natural Science Faculty

Prof. Dr. Pieter Kakisina, M.Si.

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

Contents

| | <i>Page</i> |
|---|-------------|
| Cover | i |
| Editor page | ii |
| Welcoming Address by The Organizing Committee | iii |
| Opening Remarks by Dean of Mathematic and Natural Science Faculty | iv |
| Contents | v–vii |
| Papers | |
| 1. Studies on Habitat Use and Vocal Activities of Dugongs by Using Acoustical Analysis <i>Kotaro Ichikawa, Nobuaki Arai</i> | 1–4 |
| 2. Complexation and Structural Studies of 5,5,7,12,12,14-hexamethyl-1,4,8,11-tetraazacyclotetradeca-7,14-dienium Bromide Complexes with Copper Salts <i>Bohari M. Yamin</i> | 5–10 |
| 3. Spin Wave Excitation in YFeO ₃ Crystal Investigated with Magnetic Component of Terahertz Pulse <i>Runze Zhou and Guohong Ma</i> | 11–13 |
| 4. Development on Theoretical and Application of Space Time Autoregressive Modeling <i>Budi Nurani Ruchjana</i> | 14–17 |
| 5. The Importance of Basic Science for Sustainable Marine Development in Indonesia <i>Augy Syahailatua</i> | 18–20 |
| 6. Fabrication of Novel Fibers from Rejected Ocean Materials and Their Potential Applications <i>Hendry Izaac Elim</i> | 21–27 |
| 7. Synthesis 3-benzo[1,3]dioxol-5-yl-propenal as a Precursor Asymmetric Curcumin Analogues from Kulit Lawang Oils <i>Immanuel Berly D. Kapelle, Tun Tedja Irawadi, Meika Syahbana Rusli, Djumali Mangunwidjaja, Zainal Alim Mas'ud</i> | 28–34 |
| 8. Metathesis of Ethylolate <i>Nawwar Hanun A. Malek, Nor Wahidah Awang, Kitohiro Nomura, Bohari M. Yamin</i> | 35–40 |
| 9. The Use of Fish as Carbon Sources for The Production of Riboflavin (Vitamin B2) Using <i>Eremothecium Gossypii</i> <i>Syarifuddin Idrus, Marni Kaimudin, Joice P. M. Kolanus</i> | 41–49 |
| 10. The Effect of Sampling Scheme in The Survey of Deposition of Heavy Metals in Ambon Bay by Using Spons (Porifera) Biomonitoring <i>Netty Siahaya, Alfian Noor, Nunuk Suekamto, Nicole de Voogd</i> | 50–54 |

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

| | | |
|-----|--|---------|
| 11. | Synthesis and Modification of Ni-N-TiO ₂ /Ti for Chemical Oxygen Demand Sensor with Visible Light Response Flow <i>Ruslan, Baharuddin Hamzah, Mohamad Mirzan, Musafira</i> | 55–62 |
| 12. | α -Glucosidase inhibition activity of several compounds of Fatty Acids <i>Edward J. Dompeipen, Maria A. Leha</i> | 63–69 |
| 13. | Chemical–Physics Composition Analysis of Pearl Seashells and Utilazation Possible as Import Nucleus Substitution <i>Voulda D. Loupatty</i> | 70–74 |
| 14. | Thermal Analysis in Geothermal Prospect Suli-District Central Maluku <i>J.R. Kelibulin, N.H. Pattiasina, R.R. Lokolo</i> | 75–85 |
| 15. | Characteristics Interpretation of Alteration Minerals of Waiyari Geothermal Manifestation Area, Central Maluku <i>Helda Andayany</i> | 86–89 |
| 16. | Rainfall and Rainy Days Prediction in Ambon Island Using Vector Autoregression Model <i>Lexy Janzen Sinay, Salmon Notje Aulele</i> | 90–98 |
| 17. | Applied of Backpropagation Algorithm to Analyzing and Forecasting of Currency Exchange Rate Rupiahs and Dollar <i>Dorteus Lodewyik Rahakbauw</i> | 99–108 |
| 18. | Analysis Correspondence of Data Crime in Polres Pulau Ambon dan Pulau-Pulau Lease <i>Y. A. Lesnussa, J. Pentury</i> | 109–115 |
| 19. | The Hypothetical Learning Trajectory on Place Value Concept in Realistic Mathematics Education Approach <i>Christi Matitaputty</i> | 116–124 |
| 20. | Mortality of Coral Reef in the Coastal Waters of the Hila Village Leihitu District Central Maluku <i>Deli Wakano, Dece Elisabeth Sahertian</i> | 125–128 |
| 21. | Histological of Haemocyte Infiltration During Pearl Sac Formation in <i>Pinctada maxima</i> oysters Implanted in The Intestine, Anus and Gonad <i>La Eddy, Ridwan Affandi, Nastiti Kusumorini, Yulvian Tsani, Wasmen Manalu</i> | 129–134 |
| 22. | Effect Of Ethanol Leaf Extract Gambir Laut (<i>Clerodendrum inerme</i> L. Gaertn) Malformations On Motion To External Equipment Fetal Development Mice (<i>Mus musculus</i>) <i>Chomsa Dintasari Umi Baszary, Maria Nindatu, Tony Marchel Lolonlun</i> ... | 135–139 |
| 23. | Development of Integrated Poso Lake Tourism through Community Based <i>Tabita R. Matana, Gitit IP Wacana</i> | 140–144 |
| 24. | Life Skills in Sector Marine Product Processing through Nonformal Education Approach In Maluku Province <i>Abednego</i> | 145–148 |

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

| | | |
|-----|---|---------|
| 25. | <i>Pistia stratiotes</i> and <i>Limnocharis flava</i> as Phytoremediation Heavy Metals Lead and Cadmium in The Arbes Ambon <i>Muhammad Rijal</i> | 149–155 |
| 26. | Effect to used consentartion dose fertilizer Bokshi leaf of lamtoro to growth of <i>Solanum melongena</i> L <i>Cornelia Pary, Wa Atima, Hanisu</i> | 156–160 |
| 27. | Analysis The Maturity Level of Plantain Fruit (<i>Musa paradisiaca</i>) by Using NIR Spectroscopy <i>Efraim Samson</i> | 161–166 |
| 28. | Morphological Diversity of Numege Mother Trees and Seedlings in Lilibooi Village, Ambon Island <i>Helen Hetharie, Simon H.T. Raharjo, Kosmas Rahado, Meitty L. Hehanussa</i> | 167–173 |
| 29. | Sustainability Analysis Management Coral Reef Ecosystem in The Water of The Bay Of Ambon <i>Pieter Th. Berhitsu, Sahala Hutabarat, Supriharyono, Djoko Suprpto</i> | 174–185 |
| 30. | The Environmental Management Philosophy of Indigenous Peoples in Coastal Marine Area in Maluku <i>Reveny Vania Rugebregt</i> | 186–195 |

Synthesis and Modification of Ni-N-TiO₂/Ti for Chemical Oxygen Demand Sensor with Visible Light Response Flow

Ruslan¹, Baharuddin Hamzah², Mohamad Mirzan¹, Musafira¹

¹Department Of Chemistry, The Faculty of Mathematics and Natural Sciences, Tadulako University, 94117 Indonesia.

²Department of Chemistry, The Faculty of Teaching and Educational Sciences, Tadulako University, 94117 Indonesia

Email: ruslan_abdullah66@yahoo.co.id

ABSTRACT

Preparation has been carried out Ni-N-TiO₂ thin film nano-sized, which is attached to the glass substrate. Preparation of thin layers (films) N-TiO₂ done by dip coating into the sol-gel prepared by reflux and then calcined at 450 °C. The film characterization is with DRS, XRD, FTIR, SEM, BET, and potentiostat. DRS measurement results indicate wavelength in the visible region, XRD measurements showed that the resulting film is dominated by the Ni-N-TiO₂ in the anatase form and has a size of 15.56 nm crystallite size. While the results of the FTIR characterization indicates Ti-O, -NO and Ti-N bond. Meanwhile SEM measurements show that small crystal size. Pore surface area of composite Ni-N-TiO₂ from the result of measurement has a surface area of 92.79 m²/g Photoelectrochemical test with potentiostat, by placing the film Ni-N-TiO₂/Ti as the working electrode and the current response of light to produce Ni-N-TiO₂/Ti. This system can be developed into a useful sensor for determining COD in a way that has never existed before.

Keywords: *Doped Ni-N, titanium dioxide, Chemical Oxygen Demand, Visible.*

INTRODUCTION

The development of the industry rapidly in addition providing many benefits to improve the quality of life which being serious impact on the surrounding environment. The use of toxic and hazardous chemicals as well as waste and pollution generated overwhelmed amount and it has been damaged and threatened the stability of the ecosystem even at low concentrations, most of the natural water, domestic water and industrial water containing organic substances that can cause a decrease in oxygen levels in the water. Since the determination of organic substances content in water and waste water is one of the important parameters to determine the quality of the water. Currently there are two standard analytical methods that have been used for the determination of oxygen demand in water is BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) ^[1-3].

The method for determining COD can be classified into two categories. First, the method is based on the principle of conventional chemical oxidation and simple in process analysis. Second, the method based on electro catalytic oxidation of organic matter and accompanied electro chemical measurements^[4].

Meanwhile, Zhao *et al* had reported a new method as an alternative method of measuring COD. The proposed method was based on the combined photo catalytic and

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

electrochemical, with a completely new approach. They used the TiO₂ films coated on ITO-coated glass substrate (Indium Tin Oxide), as an anode in a photo electrochemical system. Light currents rose when running a photo electrochemical system had been evaluated and used as a quantity that could be correlated with the value of COD. However, these methods still work area narrower, the COD value range to 60 mg/L of O₂. On the other hand, the design of the electrode where the data direction of photons to activate photo electro catalysis of direction must pass through the body of water sample inviting vulnerability to disruption of high absorption by water sample matrix (UV-chromospheres, suspended particles and floating solids)^[5-7].

Sunlight reaches the earth as an abundant source of energy in the Earth's surface. This abundance would greatly beneficial if available a photo catalyst that could be activated by using the sun light. Several researchers had done a matrix modified TiO₂ photo catalyst that could be activated by visible light. One modification was done by inserting another atom (dopants) into the TiO₂ crystal matrix, where in the dopant elements to make new catalyst matrix has a value smaller energy gap equivalent to the visible light energy^[8].

Dopants could be used by dividing into two types, namely as the dopant metal and non-metal. Non-metallic dopants were used to modify the energy band gap of TiO₂ to be active against visible light. N dopant substitution on TiO₂ catalyst was the most effective used to reduce the energy band gap. Morikawa *et al*, 2001 reported that mixing of p states and N 2p states of O could raise the valence band to be able to reduce the band gap of TiO₂, while the position of the conduction band remains. This leads were more active TiO₂ photo catalysts for visible light. However, Jinlong *et al* in 2010 reported that the addition of dopants N into TiO₂ photo catalyst system into N-TiO₂ composite still had many obstacles such as the difficulty of generating a composite catalyst with high N concentrations, low photo catalytic activity in the UV wavelength range, instability species N in catalyst system after the photo catalytic process, weak oxidation power generated and the high hole recombination rate as a result of the narrowing of the band gap and impurity catalyst factor^[9,10].

Efforts to incorporate dopants N which can increase activity of TiO₂ photo catalyst in the visible light radiation with metal dopants could prevent recombination between electrons and holes for COD sensor application development, has not been widely studied. In this study, TiO₂ will be modified with a non-metal dopant N (nitrogen) and Ni metal. The addition of additional Ni dopant in the N-TiO₂ catalyst system is expected to improve the performance of the process of reform-photo catalyst in its application to the development of sensors COD. The addition of Ni dopant on the one hand can serve as the active core on TiO₂ photo catalytic process as well as the electron trapper to prevent recombination of electron-hole so as to improve the photo catalytic performance in the measurement of the oxygen content in the waste water. On the other hand, the addition of Ni dopant can improve the stability of nitrogen species in the nanocomposite catalyst system to be prepared.

In this study, TiO₂ will be modified with the dopant metal and non-metallic Ni N (nitrogen) in the Ti plate substar. The addition of additional dopant N on TiO₂ catalyst system is expected to improve the performance of the process of reform-photo catalyst in its application to the development of COD sensors that can be used in the visible light region. The addition of dopants N on one side can function as an active nucleus in TiO₂ photo catalytic process as well as the electron trapper to prevent recombination of electron-hole so as to improve the photo catalytic performance in the measurement of the oxygen content in the waste water^{[6] [7]}.

Crucial point in the development of photo electrochemical cell systems mentioned above is the preparation of the film Ni-N-TiO₂ nano-sized in order to obtain the film anode

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

having a large surface area and very active. Sol-gel method and calcinations used to obtain films of Ni-N - TiO₂ as desired. This paper will report the results of the film characterization of Ni-N-TiO₂ produced and used as the working electrode in the determination of COD-based photo electrochemical.

METHODS

Materials Research

The materials used in This research is Titanium tetra iso Proposida (TTIP) 97% aldirch, Ethanol 95%, Aceton, 2-propanol, 0.1 M NaNO₃, distilled water, HCl 31%, 40% HF, HNO₃, acetylacetonate, Urea, Ni(NO₃)₂.3H₂O, Plate Ti, NH₃, aquabidest.

Synthesis of Ni-N-TiO₂ Sol-gel Method

The initial step in synthesizing Ni-N-TiO₂ sol-gel method is to make two solutions, where a solution of 1 in the form of a colloidal solution of TiO₂ prepared by controlled hydrolysis of titanium tetra iso-propoxide (TTIP) taken in a total of 5 mL and 0.5 mL ethanol acetylacetonate or 2-propanol 15 ml were included in the reflux flask. Two solutions in the form of 15 ml of ethanol and 1 mL of distilled water with the addition of 10 drops of acetic acid were put into a separating funnel and then a solution of 2 is added to a solution of 1 gradually through the funnel while stirring using a magnetic stirrer. The mixture solution was refluxed for 2 hours at 40°C.

The next step is continued for doping of TiO₂ with urea as a nitrogen source, the same sol was then stirred using a magnetic stirrer followed by the addition of a nitrogen source mole ratio of N: Ti 1%, 2% and 3% to produce TiO₂ sol containing nitrogen for 2 hours at 40°C. After the addition of Ni mole ratio of Ni: Ti is 1%, 2% and 3%.

Electrode Preparation

a. Ti Plate (titanium)

Plate Ti (titanium) which has been previously prepared by sol immobilized TiO₂ and N-TiO₂ superimposing manner on the surface of the plate evenly with deep technical coatings. Then the plate was allowed to dry and calcinated using furnace at a temperature of 450°C for 2 hours to allow the formation of anatase crystals is progressing well. In order to obtain a uniform thin layer on the surface of the plate, the coating process is repeated three times.

b. Catalyst Characterization of Ni-N-TiO₂

Characterization is performed to determine whether the products are in accordance with the intended purpose or not. Products may include TiO₂, N-TiO₂ and Ni-N-TiO₂ and TiO₂ films synthesized, N-TiO₂ and Ni-N-TiO₂ were successfully prepared. Characterization used UV-Vis DRS, XRD, SEM, FTIR and BET for TiO₂ and N-TiO₂ synthesized, whereas the film of TiO₂ and N-TiO₂ were characterized using electrochemical system or a potentiostat.

RESULTS AND DISCUSSION

Characterization by UV-Vis DRS

Characterization by means of UV-Vis DRS conducted to obtain information band gap crystal TiO₂ and N-TiO₂ synthesis results are used. The results of the analysis of UV-Vis DRS TiO₂ catalyst, N-TiO₂ and Ni-N-TiO₂ were showed in Table 1.

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

Tabel 1. Band Gap Energy Calculation Results TiO₂, N-TiO₂ (Urea-dope TiO₂) and Ni-N-TiO₂

| No | Cuplikan | Gap Energy |
|----|------------------------------------|------------|
| 1 | TiO ₂ Degussa P-25 | 3.35 |
| 2 | TiO ₂ pH 3 | 3.20 |
| 3 | N (Urea 2 %)-dope TiO ₂ | 3.00 |
| 4 | Ni (1 %)-dope N-TiO ₂ | 2.55 |
| 5 | Ni (2 %)-dope N-TiO ₂ | 2.60 |
| 6 | Ni (3 %)-dope N-TiO ₂ | 3.06 |

In Table 1, it can be seen that the value of the band gap of, TiO₂ synthesis and nitrogen doped TiO₂ and N-TiO₂ with addition of dopants Ni variations have different values.

The band gap can be used to calculate the wavelength of the formula:

$$E_g = h \frac{c}{\lambda} = (eV) \quad (1)$$

The optimum value of the band gap is obtained at a concentration of 1% urea. Mean wavelength of 486 nm. With the decline in the value of the band gap energy of light is then required to establish photohole (conduction band) and photoelectron (valence band) will be smaller, for example, simply by using a visible light source.

Characterization by X-ray diffract meter (XRD)

Characterization by means of XRD performed to obtain information TiO₂ crystal structure, the N-TiO₂ and Ni-N-TiO₂ synthesis results. Material TiO₂, N-TiO₂ and Ni-N-TiO₂ were analyzed are not the result of calcinations gel coated on Ti substrate plate, but get the same heat treatment with the Ti coated on the substrate plate.

Figure 1 is an XRD spectrum analysis results TiO₂ catalyst, N-TiO₂, and Ni-N-TiO₂. In the image showed the peaks that can provide identity information crystalline form of TiO₂, N-TiO₂, and Ni-N-TiO₂ prepared in this study. Crystal shape can be determined by comparing the value of 2θ or d (Å) the results of measurements with data interpretation card standard TiO₂ crystals.

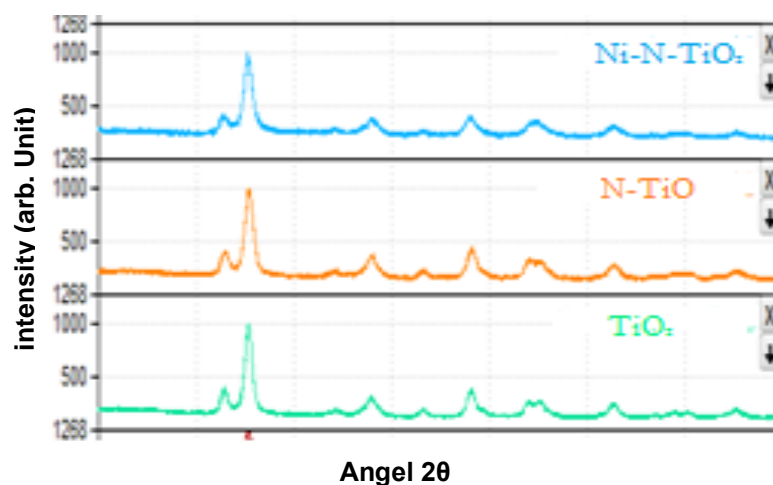


Figure1. XRD spectrum of TiO₂, N-TiO₂, and Ni-N-TiO₂

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

The peak of diffractogram obtained with the help of Scherrer equation, can be predicted crystallite size of each crystal, which is 17.89 nm for TiO₂ catalyst, 15.43 nm for N-TiO₂ catalysts, catalyst and 15.56 nm for Ni-N-TiO₂.

The results of XRD analysis showed the peak $2\theta = 25.3^\circ$ which is the peak of anatase. And absence of peak $2\theta = 27.4^\circ$ which marks the rutile crystal type, so it can be concluded crystals formed a kind of anatase crystals. In addition, the crystal form can be determined by comparing the value of 2θ or d (Å) the results of measurements with data interpretation card standard TiO₂ crystals.

Characterization of FT-IR (Fourier Transform Infra Red)

A measurement with FTIR aims to identify indications of the existence of a bond between the Ti-O-, and the presence of nitrogen or Ni in the TiO₂ matrix synthesis results. Measurements with FTIR aim to identify indications of the presence of the Ti-O bond, the presence of nitrogen and Ni in the TiO₂ matrix synthesis results.

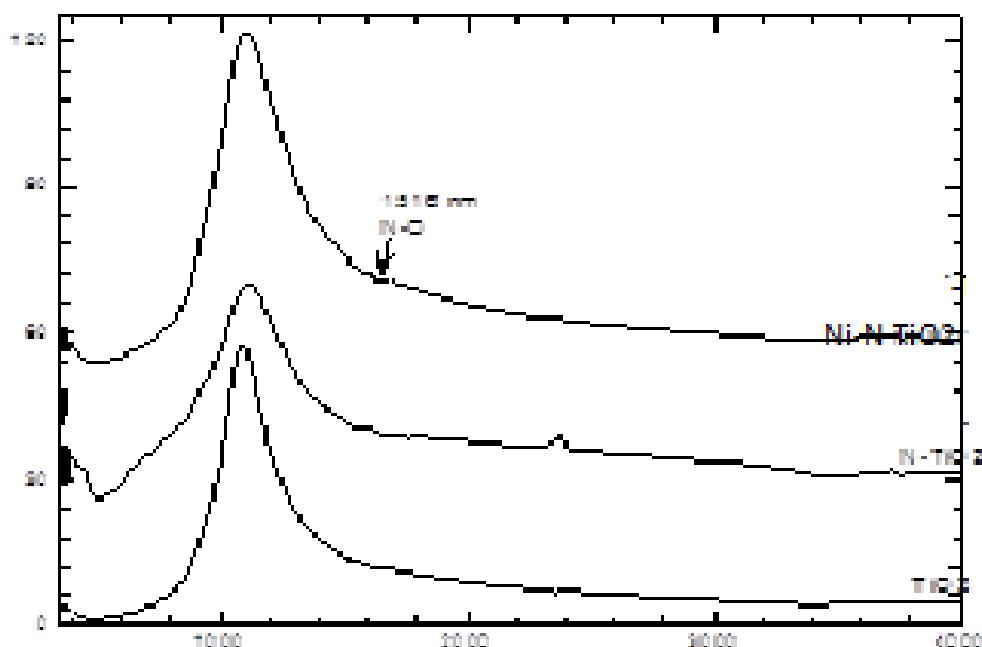


Figure 2. FT-IR spectra of TiO₂, N-TiO₂, and Ni-N-TiO₂

In Figure 2. it could be observed the characteristics of the bond O-Ti-O and the wave number region 400-1250 cm⁻¹. There was also an absorption peak at 3500-3000 cm⁻¹ which was a characteristic of the OH stretching vibration and 1625-1650 cm⁻¹ indicates peak OH bending vibrations emanating from the solvent is trapped in the crystal structure of TiO₂, or group titanol and 1000-1300 cm⁻¹ is the absorption peak for CO stretching vibration originating from combustion is less than perfect [11],[12].

J.Sabatayté, *et al* (2006) reported the bond absorption in the Ti-O-Ti is at 440 cm⁻¹. In the area were also reviewed in the crystal, found that the absorption peak profile resulting from the synthesis of TiO₂ results similar to the profile of the TiO₂ Degussa P25, but there are some differences in the absorption peak of N-TiO₂, and Ni-N-TiO₂ was the catchment area 430 cm⁻¹ which indicates the role of N, and Ni in Ti bond [13].

Indication of the presence of Ti-O bond is thought to occur in the absorption peak of 600 cm⁻¹. Meanwhile appearance peak absorption at 1510 cm⁻¹ (symmetric vibration) which indicates the existence of groups -NO. Allegedly on nitrogen uptake occurs insertion into the

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

TiO₂ matrix. In addition, an indication of the presence of Ti-N bonds are at the height of 508 cm⁻¹ with a weak signal. Allegedly the amount of nitrogen present in the catalyst is very little^{[14],[15]}.

Characterization by SEM

The results of SEM measurements provide information about the surface topography on the surface of a crystal.

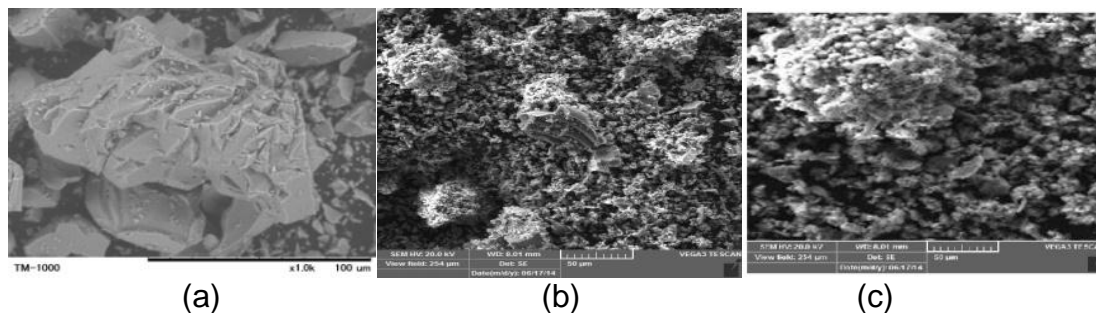


Figure 3. SEM Characterization Results: (a) TiO₂, (b) N-TiO₂, (c) Ni-N-TiO₂

In Figure 3. (a) crystalline form of large size and large blob, this can be caused by the presence of the solvent is trapped in the crystal structure of TiO₂ which can be explained from the appearance of the peak related to the OH vibration FTIR spectra obtained previously. In figure 3 (b) crystal sizes smaller than TiO₂, this is due to the effect of nitrogen doping, whereas in Figure 3 (c) shows the shape of the porous crystalline structure and this affects the activity of the catalyst. Photo catalytic process takes place on the catalyst surface, the smaller the particle size the more active surface area collides with the substrate to accelerate the photo catalytic reaction.

Characterization by BET

Isothermal adsorption BET used to characterize the surface of Ni-N-TiO₂ synthesis results. BET also known as nitrogen adsorption focusing on bond style gas adsorbed on the surface of the absorbent, is not only limited to a single layer only. Characterization of pore properties and specific surface area of the sample studied by the BET adsorption isotherm analysis on Ni-N-TiO₂, which was produced from the sol-gel process (from precursor TTIP), each with the help of reflux hydrothermal process and help acetyl acetone, and calcinations 450°C showed that the Ni-N-TiO₂ used in this study has a specific surface area of 92.79 m²/g. The obtained surface area was smaller than the Degussa P25 with a broad 53,60m²/g. The pore volume of 0.0042 cm³/g, and 15.97Å pores diameter. A decrease in the surface area of the composite Ni-N-TiO₂ are thought to originate from Ni metal ions and non-metallic ions N immobilized on TiO₂ composite structure causes a decrease in surface defects. Elements Ni and N were immobilized on TiO₂ framework would lead to changes in the bond that can alter the structure of the arrangement of atoms less regulated so that the surface area decreases.

CONCLUSIONS

Synthesis of Ni-N-TiO₂ had done by adding urea mole ratio of 1%, 2%, and 3%. Where the addition of nitrogen in TiO₂ catalyst capable of lowering the energy band gap, with the smallest value of the band gap was 3:00 eV in the N-TiO₂ 2% and the addition of Ni metal

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

was able to reduce the band gap of 2.55 eV with a comparison to Ni: Ti 1%. Ni-N-TiO₂, and N-TiO₂ synthesis results could be active in the visible area based on data from the characterization of UV-Vis DRS; XRD on TiO₂ anatase crystalline form, the N-TiO₂ and Ni-N-TiO₂; FTIR data Ti-O bond (600 cm⁻¹), -No bond (1475 cm⁻¹), Ti-N bond (508 cm⁻¹) showed the presence of N on N-TiO₂; SEM for Ni-N-TiO₂ had a porous structure and small size.

ACKNOWLEDGEMENTS

Research Grant Universities through Hibah Pekerti for Research Fund in Financial Year 2014. Prof.Dr.H.Abdul Wahid Wahab, M.Sc. and Prof. Dr H. Muh. Nurdin, M.Sc. as TPM in Hibah Pekerti Research who was always encouraged the researcher to conduct research, particularly in research on photo electro catalytic.

REFERENCES

- [1]. Fujisima, A., and Honda, K., *Electrochemical Photolysis of Water at A Semoconductor Electrode*. Nature, 1972, 238, 37- 38.
- [2]. Nurdin, M., *Pengembangan Sistem Sensor Chemical Oxygen Demand Berbasis Elektrokatalisis Menggunakan Elektroda Berlapis Partikel Titanium Dioksida Berukuran Nano*, D. Universitas Indonesia, 2008.
- [3]. Christina, M., Mu'nisatun, S., Saptajji, R., Marjanto, D., *Studi Pendahuluan Mengenai Degradasi Zat Warna Azo (Metil Orange) dalam Pelarut Air Menggunakan Mesin Berkas Elektron 350 keV/10 mA*, BATAN, Yogyakarta.2007.
- [4]. APHA: "*Standard Methods for the Examination of Water & Wastewater*" 1^{8th} Ed. Washington, 1992.
- [5]. Y.C. Kim, S. Sasaki, K.Yano, K.Ikebukuro, K. Hashi moto, and I. Karube: "*Relationship between Theoretical Oxygen Demand and Photocatalytic Chemical Oxygen Demand for Specific Classes of Organic Chemicals*". *Analyst*, 2000, 125, 1915-1918.
- [6]. H. Zhao, D.Jiang, S.Zhang, K.Catterall, and R.John: "*Development of Direct photoelectrochemical Method for Determination of Chemical Oxygen Demand*". *Anal. Chem*, 2004, 76: 155-160.
- [7]. He, C., X.Z. Li, X.Z., Graham, N., and Wang, Y. 2006, *Preparation of TiO₂/ITO and TiO₂/Ti photoelectrodes by magnetron sputtering for photocatalytic application*, *Applied Catalysis A: General*, 2006, 305, 54–63.
- [8]. Ruslan and Mirzan, *Sintesis dan Karakterisasi Elektroda N-TiO₂ dan N-TiO₂/ITO untuk Sensor Chemical Oxygen Demand dengan Respon Arus Cahaya Visible*, Hibah Bersaing, Universitas Tadulako, 2013.
- [9]. Morikawa, T., Asahi, R., Ohwaki, T., Aoki, K., and Taga, Y., *Visible-Light Photocatalysis in Nitrogen-Doped Titanium Oxides*, *Jpn. J. Appl.Phys*, 2001, Vol. 40: L561.
- [10]. Jinlong Zhang, Yongmei Wu, Mingyang Xing, Leghari, Sajjad Ahmed Khan, Sajjad Shamila. *Development of modified N doped TiO₂ photocatalyst with metals, nonmetals and metal oxides*. *Energy Environ. Sci.*, 2010, Volume 3, 715-726.
- [11]. Jagadale, T. C., Takale, S. P., Sonawane, R. S., *N-Doped TiO₂ Nanoparticle based Visible Light Photocatalyst by Modified Peroxide Sol-Gel Method*, *J. Phys. Chem. C*, 2008, 112 (37), 14595-14602.
- [12]. Wang, J.; Zhu, W; Zhang, Y.; Liu, S, *An Efficient Two-Step Technique for Nitrogen-Doped Titanium Dioxide Synthesizing: Visible-Light-Induced Photodecomposition of Methylene Blue*, *J. Phys. Chem. C*, 2007, 111 (2), pp 1010–1014.

PROCEEDINGS

1st International Seminar of Basic Science, FMIPA Unpatti - Ambon
June, 3rd – 4th 2015

- [13]. J. Sabataityte, I. Oja, F. Lenzmann, O. Volobujeva, and M. Krunks, *Characterization of nanoporous TiO₂ films prepared by sol-gel method*, Comptes Rendus Chimie, 2006 vol. 9, no. 5-6, pp. 708–712.
- [14]. Slamet, H.W. Nasution, E. Purnama, S. Kosela, J. Gunlazuardi, *Photocatalytic Reduction of CO₂ on Copper-Doped Titania Catalysts Prepared by Improved-Impregnation Method*, Catalysis Communication, 2005, 6 (5), 313-319.
- [15]. Nolan, N.T., Synnott, D.W., Seery, M.K., Hinder, S.J., Wassenhoven, A.V., Pillai, S.C., 2012, *Effect of N-doping on the photocatalytic activity of sol-gel TiO₂*, Journal of Hazardous Materials, 211– 212: 88– 94.