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Journal of Physics: Conference Series

Volume 1295, Issue 1, 8 November 2019, Article number 012074

3rd International Conference on Chemical and Material Engineering, ICCME 2018; Department of Chemical Engineering, Faculty of Engineering, Diponegoro University Semarang; Indonesia; 19 September 2018 through 20 September 2018; Code 155151

A Comparative Study on FeCrAl Alloy and NiCrSi Alloy Materials as Heating Element at Low Energy Oven (Conference Paper) (Open Access)

Syakur, A.^a ✉, Vingsabta, V.^a, Swastawati, F.^b, Wijayanti, I.^b

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Abstract

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In this era we need lower energy consumption in electronic devices, example on oven. There is a heating element inside the oven. The heating element should produce high temperature with low energy consumption. Heating element in this research use FeCrAl alloy and NiCrSi alloy. FeCrAl alloy or Kanthal A-1 wire consists of 20% chromium, aluminum and ferum. NiCrSi or Nichrome 80 consist of 80% nickel, 19,5% chromium and 1,45 silicon. The reason using these both wire, because both of wire have high resistivity and produce high temperature. In this research using FeCrAl alloy and NiCrSi alloy 0,8 mm with variations in coil diameter 10 mm. Both of wire applied in oven 40 cm x 40 cm x 50 cm to produce 40 °C. From FeCrAl alloy dan NiCrSi alloy to produce 40 °C with same voltage input, NiCrSi 0,8 mm with 10 mm diameter produced power 170 Watt took 4.4 minutes to reach 40 °C and the energy consumption is 12,5 Wh. With same diameter FeCrAl produced power 210 W took 4,4 minutes to reach 40 °C and energy consumption is 15,4 Wh. From the data results show that the NiCrSi alloy has lower resistance value than the FeCrAl Alloy. It can be concluded that NiCrSi alloy diameter of 0.8 mm with a winding diameter of 10 mm consumes low energy in generating heat. © 2019 Published under licence by IOP Publishing Ltd.

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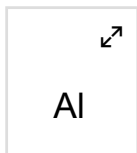
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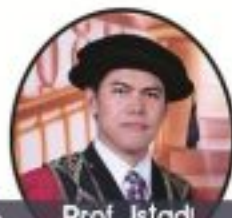
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Tunghai Univ., TaiwanProf. A. L. Ahmad
USM, MalaysiaProf. Li Xiaodong*
Zhejiang Univ., China

*in confirmation

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- Heat and mass transfer *
- Chemical reaction engineering and catalysis *
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- Separation and purification *
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- Clean production including waste disposal *
- Energy conversion and development *
- Sustainable Development and Higher Education in Chemical Engineering *
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- Smart/Intelligent & Functional materials *
- Polymer synthesis and modification *
- Surface engineering and coating *
- Material forming *
- Modeling, Analysis and Simulation of Manufacturing Processes *

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International participants	350 USD
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Indonesian participants	3,000,000 IDR
Indonesian students	2,000,000 IDR
Audience - participants*	2,000,000 IDR
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- IOP Proceeding Conference (SCOPUS indexed)
 - Bulletin of Chemical Reaction Engineering & Catalysis (SCOPUS indexed)
 - Journal of Physical Science (SCOPUS indexed)

★ SUBMISSION & REGISTRATION

Authors are invited to submit their papers at the ICCME 2018 website: iccme2018.undip.ac.id
Detailed instructions are shown at the CALL FOR PAPER AND REGISTRATION page.

★ IMPORTANT DATES

Abstract submission	10th August 2018
Acceptance notification	13 th August 2018
Paper submission deadline	25 th August 2018
Final Registration	3 rd September 2018
List of oral presentations	10 th September 2018
Conference Days	19th September 2018

2nd ANNOUNCEMENT

📍 LOCATION

Grand Candi Hotel, Semarang
Jalan Sisingamangaraja No.16, Kaliwiro, Candisari, Kota Semarang,
Jawa Tengah 50232

📞 CONTACT PERSON

Departement of Chemical Engineering, Diponegoro University
Jl. Prof. Soedarto, SH, Semarang, Indonesia 50275
Tel/Fax: (+62) 24-7460058/(+62) 24-76480675
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Prof. Hong-Wei Yen
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Prof. Abdul Latif Ahmad*
USM, Malaysia

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Assoc. Prof. Oki Muraza
KFUPM, Saudi Arabia

[see more](#) ^{*in confirmation}



Assoc. Prof. L. Samavedham
NUS, Singapore

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Preface

International Conference on Chemical and Material Engineering (ICCME) 2018

The 3rd International Conference on Chemical and Material Engineering (ICCME) 2018 was held by the Department of Chemical Engineering - Universitas Diponegoro in conjunction with the 60th anniversary of Faculty of Engineering - Universitas Diponegoro. The event was conducted on September 19th 2018 in Grand Candi Hotel Semarang - Indonesia. This event was the continuation of the preceding conferences held in 2013 and 2015. The ICCME 2018 brought “Chemical and Material Engineering for Sustainable Foods, Energy, and Environment” as the grand theme. The objectives of this conference are:

- To disseminate and develop the most recent innovations, trends, and concerns as well as practical challenges encountered and solutions in the fields of chemical and material engineering.
- To encourage international collaborations and joint ventures
- To promote and facilitate the growth of scientific and technical development in the field of chemical and material engineering development in Indonesia and the Asia region

Although the organizing committee received a total of 115 abstract papers, the scientific committee decided that only 97 papers were eligible for oral presentations which came from Indonesia, Malaysia, Myanmar, the Philippines, Taiwan, Japan and Austria. In addition, 3 keynote and 3 invited speakers from abroad were presented during this conference. This special issue proceeding presents 76 papers selected from the presented papers after being thoroughly peer reviewed.

Special thanks are due to all keynote and invited speakers for their participation, to the Organizing Committee members for all their hard work in making the conference to happen, especially Universitas Diponegoro Chemical Engineering Master Program students who generously supported the conference. The Scientific Committee members are also thanked for reviewing the submitted manuscripts and for assisting in the editorial process. Finally, all who travelled to Semarang, Indonesia for the meeting are acknowledged for deciding to attend and contribute to making this a successful conference.



We greatly hope that this proceeding will be advantageous in future implementations of chemical and material engineering, not only to the academia, but also to the industries by which broadening our scientific perspective.

Andri Cahyo Kumoro & Dyah Hesti Wardhani

Conference Scientific and Organizing Committee Chairs

Conference Scientific Committee:

1. Prof. Dr. Andri Cahyo Kumoro, ST, MT (Chair-Indonesia)
2. Prof. Dr. Hadiyanto, ST, MSc (Indonesia)
3. Prof. Hong-Wei Yen (Taiwan)
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A Comparative Study on FeCrAl Alloy and NiCrSi Alloy Materials as Heating Element at Low Energy Oven

Abdul Syakur^{*1}, Veinard Vingsabta², Fronthea Swastawati³, Ima Wijayanti⁴

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Abstract. In this era we need lower energy consumption in electronic devices, example on oven. There is a heating element inside the oven. The heating element should produce high temperature with low energy consumption. Heating element in this research use FeCrAl alloy and NiCrSi alloy. FeCrAl alloy or Kanthal A-1 wire consists of 20% chromium, aluminum and ferum. NiCrSi or Nichrome 80 consist of 80% nickel, 19,5% chromium and 1,45 silicon. The reason using these both wire, because both of wire have high resistivity and produce high temperature. In this research using FeCrAl alloy and NiCrSi alloy 0,8 mm with variations in coil diameter 10 mm. Both of wire applied in oven 40 cm x 40 cm x 50 cm to produce 40 °C . From FeCrAl alloy dan NiCrSi alloy to produce 40 °C with same voltage input, NiCrSi 0,8 mm with 10 mm diameter produced power 170 Watt took 4.4 minutes to reach 40 °C and the energy consumption is 12,5 Wh. With same diameter FeCrAl produced power 210 W took 4,4 minutes to reach 40 °C and energy consumption is 15,4 Wh. From the data results show that the NiCrSi alloy has lower resistance value than the FeCrAl Alloy. It can be concluded that NiCrSi alloy diameter of 0.8 mm with a winding diameter of 10 mm consumes low energy in generating heat

Keywords: FeCrAl Alloy, NiCrSi Alloy, resistivity, heating element, energy consumption

1. Introduction

The need for human life at this time is increasingly complex, so that to help everyday life is needed practical, low cost and safe technology. This technological advancement is certainly not only aimed at the technology itself but more importantly for human welfare. One of the uses is in the industrial sector. In one industry, the process of drying fish. Then we need an oven that is safe, economical and environmentally friendly. In oven is used a heater to dry the fish, the heater has various type [1].

Oven is a device used to dry a wet material into dry material so that it can be stored for a long time. The drying process with the oven uses a medium that can hold the heat temperature constantly. The oven generally uses a heater [2][3].

As a source of heat generated by electric heating elements sourced from high-resistance wire or tape (resistance wire) usually the material used is Niklin wire which is rolled like a spiral shape and inserted in pipe as a insulator, then injected by electric current at both ends and coated with an electrical insulator that is able to continue heat well until it is safe to use . The shape and type of the electrical heating element varies according to the function of the installation place [4].



Gas permeation properties and preparation of carbon membrane by PECVD method using indene as precursor

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S Suzuki²

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Manila 0922, Philippines

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Abstract. This work could demonstrate a new approach to the fabrication of gas separation membrane using indene as polymeric precursor for low pressure PECVD system. Membrane characterization was done by taking Scanning Electron Microscopy (SEM) and FTIR measurements. For membrane performance testing, permeability and selectivity of the membrane were evaluated with pure gases of H₂, N₂, and CO₂ using a differential permeation technique. PECVD-derived polyindene membrane showed selectivities of 8.2 and 4.0 for H₂/CO₂ and H₂/N₂, respectively, at room temperature. Polyindene (PI_n) membrane was successfully fabricated onto a zeolite 5A substrate via radio frequency plasma-enhanced chemical vapor deposition (RF-PECVD) at room temperature.

1. Introduction

Membranes in gas separation has been applied because of its advantages such as low energy requirement and low operating cost. In this perspective, the interest on inorganic membranes such carbon membrane for gas separation has also grown for showing higher selectivity and remarkable high thermal and chemical resistances [1]. Generally, a carbon membrane is fabricated by the pyrolysis of an organic precursor and this membrane shows very good molecular sieving effect in gas separation [2]. Normally, membrane fabrication via pyrolysis technique can be done at processing temperature of 500°C and above [1]. For instance, Teixeira et al. fabricated supported carbon membrane using phenolic resin solution by pyrolysis technique with heating up to 900°C under nitrogen atmosphere. In their research work, the resultant membrane showed significant performance in terms of gas separation and selectivity [3]. In this method, it needs high temperature to decompose the polymeric precursor in membrane fabrication process.



Morphological and Optical Properties of Polylactic Acid Bionanocomposite Film Reinforced with Oil Palm Empty Fruit Bunch Nanocrystalline Cellulose

E Indarti^{1*}, Marwan² and W D. Wan Rosli³

¹Department of Agricultural Product Technology, Faculty of Agriculture, Syiah Kuala University, Darussalam, Banda Aceh 23111, Indonesia

²Department of Chemical Engineering, Faculty of Engineering, Syiah Kuala University, Darussalam, Banda Aceh 23111, Indonesia

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Abstract. Nanocrystalline cellulose (NCC) was derived from oil palm empty fruit bunch (OPEFB) by soda pulping and followed by 2,2,6,6-tetramethylpiperidine-1-oxy (TEMPO) oxidation reaction method. The NCC was used as reinforcing agent in Polylactic acid (PLA) biopolymer film matrix with 0 to 20% loadings. Bionanocomposite film was prepared by dilution in Chloroform and casted on the flat glass with 0.03-0.05 mm casting thickness. TEM shows that the nanocrystalline cellulose (NCC) has a rod like shape of 2-6 nm width and 200-500 nm length. SEM micrograph shows that the surface of PLA-NCC bionanocomposites has a relative good dispersion at low NCC loading (1, 3 and 5 wt.%), and a rougher surface at higher NCC loadings. The PLA bionanocomposites film as obviously seen exhibits decrease in transparency as the NCC content increased. The transparency of neat PLA film has higher transmission value compare to other PLA-NCC and tend to reduce the transmission percentage as the NCC loading increase, especially for 10 and 20%.

1. Introduction

The use of biopolymer is growing as more concerns on environmental impacts of petroleum based plastics. One of the most valuable biopolymer is polylactic acid (PLA) due to some advantage properties, for instances renewability, biodegradability, compatibility and excellent in transparency. However PLA has shortcoming such as low thermal resistance, brittles, and poor gas and water vapor permeability [1]. To extend its applications, improvement of its properties is required. One of the most promising material to enhance the properties of the PLA is cellulose as many researches have shown recently [2-5].

In general, preparation of biodegradable plastics requires fillers as reinforcing phase made of bioresources. Many studies have shown that various forms of nano-size cellulose have been incorporated into PLA matrix have contributed to improved mechanical and barrier properties of the biocomposites [6, 7]. Growing interest in nanocomposites has been related to several reasons, among them are possible to design and create new materials and structures with exceptional flexibility and physical properties,

