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RESEARCH IN THERMOFLUID AND MATERIALS FOR BETTER INDUSTRIAL PRODUCTS

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Interdisciplinary linkage in research is needed to develop better solutions that will meet the needs of industries for greater efficiency and environment-friendly standards. Research and innovation in the fields of thermofluid and materials science and engineering, as an interdisciplinary research field, need to be continuously encouraged so that the growing needs of industries, such as thermal storage, power generation, drag reduction, safety, manufacture, and industrial management, are met. More precise prediction methods and innovations in design and manufacturing processes continue to be undertaken by some researchers, as presented in this edition of the International Journal of Technology (IJTech). From these studies, we can see that the optimization of a product or system is determined by its mechanical parameters, material properties, and process management.

At the close of this year, we are very pleased to present a special edition of IJTech. This special edition is a series containing some of the best papers we selected from the 15th International Conference on Quality in Research (QiR) 2017, a two-year event organized by the Faculty of Engineering of Universitas Indonesia. We present 21 papers in the research areas of mechanical, material, and industrial engineering. This edition will cover studies in the fields of energy conversion and conservation, materials, and manufacture.

The first paper, written by M.A. Budiyanto and T. Shinoda, investigates the stacking effect on power consumption in three stacks of refrigerated containers. The authors found that the stacking of refrigerated containers affected the temperature stratification in container surfaces and caused a different order of energy consumption in each tier of the containers. The authors stated that the results will help container port operators achieve energy saving in refrigerated containers through the proper arrangement of these containers.

The second paper, written by F.A. Rayhan and A.S. Pamitran, develops and investigates the performance of a seawater ice slurry generator with a mechanical scraper. R-290 and R-22 were used as the working fluid for the refrigeration system. The study showed that the operation condition with a higher scraper RPM took more time to produce ice slurry, but it could prevent freezing. The higher was the pump RPM operation condition, the faster was the decrease in sea water temperature. The authors concluded that the performance of the refrigeration system with R-290 was better than that with R-22.

The third paper, written by N.A. Abdullah, N. Putra, I.I. Hakim, and R.A. Koestoer, provides the latest information on the improvement of the liquid collection system (LCS) from an existing paper and concludes with some inputs and application strategies. The authors argued that research on liquid smoke based on thermofluid is necessary. The unavailability of data on thermal properties, including local materials from Indonesia, presents opportunities to researchers in Indonesia to study more about LCS especially that based on thermofluid.

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The fourth paper, written by A. Wiyono, I.P.S.I. Pratiwi, C.R. Priadi, A. Surjosatyo, and H. Dafiqurrohman, optimize of the result of high gas producer and environmentally friendly with CO_2 levels and low tar the stage of pre-gasification, gasification, and post-combustion processes. The authors concluded that adding the volume ratio of the pellets resulted in the encroachment on the syngas heating value (lower heating value) and increased the value of the gas composition of CO and H_2.

The fifth paper, written by B. Ulum, E. Ambarita, Nurrohman, and Y.S. Gaos, evaluates the overall process used in Mount Salak Geothermal Power Plant Unit 1-2-3 to maintain the sustainability of power generation at a high efficiency. The authors found that the largest exergy losses occurred in the condensers because of the higher demand for steam to generate the turbine and produce maximum work. They recommended that further maintenance focusing on fan cooling tower (FCT) is highly needed to reduce losses in exergy in the condenser and to increase power plant efficiency.

The sixth paper, written by N. Sofyan, A. Ridhova, A.H. Yuwono, and A. Udhiarto, describes the fabrication of solar cells with TiO_2 nanoparticles sensitized using a natural dye extracted from mangosteen pericarps. The results showed that the maximum power conversion efficiency of the mangosteen natural dye was achieved with the dye extracted using ethanol containing 20% distilled water, compared with the commercial organic dye with a power conversion efficiency (PCE) of 4.02 %. The result was considered by the authors convincing and promising for further development.

The seventh paper, written by Warjito, Budiarso, A.I. Siswantoro, D. Adanta, M. Kamal, and R. Dianofitra, designs and simulates, using computational fluid dynamics, some pico-hydro Turgo turbines that can be implemented in remote areas, and examines the performance of blades that use an arc of a circle as their curve. The authors found that the blade with a 60 mm arc radius generated 477.708 Watts and 85.97% efficiency at a head of 2.7 m, speed ratio of 0.5, and a flow rate of 0.021 m^3/s, which were the highest values achieved among those of the other blades.

The eighth paper, written by D. Gasni, I.H. Mulyadi, J. Affi, and A.Y. Miswar, investigates wear mechanism in a rolling element bearing using coconut oils and palm oil as lubricant. The authors found that the vegetable oil lubricants had good lubricity compared with the grease lubricant. The worn surface was very severe with the grease lubricant. It was caused by a starvation phenomenon that occurred in the ball bearing because the film thickness was reduced.

The ninth paper, written by Yanuar, M.A. Talahatu, S. Mau, K.T. Waskito, W. Wulandari and M.A. Talahatu, investigates the characteristics of calcium carbonate nanoparticles in the flow in a pentagon spiral pipe and a circular pipe. Their observation with the same test condition showed that the drag reduction in the spiral pipe was higher than that in the circular pipe. The authors concluded that the higher drag reduction was affected by themore turbulent intensity. Furthermore, the geometry ofthe spiral pipe generateda circumferential flow that resulted in the working fluids being twisted at a certain Re. The fluid properties likewise considered the decreasing friction factor.

The tenth paper, written by K. Suastika, A. Hidayat, and S. Riyadi, investigates the effects of the application of a stern foil on ship resistance with computational fluid dynamics and towing-tank experiments by considering a 40 m planing-hull *Orela* crew boat. The authors found that at a relatively low speed (Froude number Fr<~0.45), the use of the stern foil increased the ship resistance (up to 13.9%), where as at a relatively high speed (Fr>~0.55), it decreased the ship resistance (up to 10.0%).

The eleventh paper, written by Syaiful, A. Ayutasari, M.F. Soetanto, A.I. Siswantara, and M.W. Bae, investigates the thermal and hydrodynamic performances of fluid flow through concave

delta winglet vortex generators. The authors found a good agreement between their numerical simulation results and the experimental results. The longitudinal vortex generated by concave delta winglet pairs (CDWP) vortex generator (VG) was stronger and wider than that generated by DWP VG, resulting in the improvement of heat transfer. However, the use of CDWP VG increased the pressure drop.

The twelfth paper, written by D. Larasati, Harinaldi, and R. Trisno, observes the characteristics of the different types of cavities and orifice diameters of a synthetic jet actuator, as well as the effect of frequency excitation on Synthetic Jet Actuator (SJA) performance as an active control device for reducing aerodynamic drag. The authors concluded that the maximum jet speed was generated by the synthetic jet actuator in the frequency range of 110–130 Hz with an uncertainty of 2%, and the amount of data was 10,000. The jet with the highest velocity was produced by K3 (conical-type cavity) with an orifice diameter of 3 mm.

The thirteenth paper, written by B. Alianto, N. Astari, D. Nareshwara, and Y.S. Nugroho, focuses on the smoke modelling and prediction of smoke movement in several fire scenarios. In their simulations, a basic configuration of an underground car park was chosen, and Fire Dynamics Simulator V.6 was used. The authors argued that having sprinklers, make up air fans, smoke extract fans, jet fans, and ductwork resulted in the fastest removal of smoke in the basement.

The fourteenth paper, written by A.S. Baskoro, H. Muzakki, G. Kiswanto, and Winarto, investigates the tensile strength and macrostructure in a weld nugget influenced by welding time and electrode force. The authors argued that micro resistance spot welding parameters significantly influenced mechanical properties, macrostructure, and microstructure. The increasing electrode force decreased the load rate. They also found that the effect of electrode force on the diameter and thickness of the weld nugget was not significant.

The fifteenth paper, written by G. Kiswanto, A. Mahmudah, and D. Priadi, investigates punch force behavior with some punch feed variation during the micro V-bending process using pure copper with 0.1 mm thickness as the bending specimen. The authors found that the punch force profile in the micro V-bending process consisted of free bending forces and the bottoming force. Their work showed an increase in the bottoming force with an increase in the punch speed because of the inertia effects of punch.

The sixteenth paper, written by M. Chalid, A.I. Fikri, H.H. Satrio, M. Joshua Y.B., and J.F. Fatriansyah, examines the effect of melting temperature on the rate of solidification in polymer by using a modified phase field model. To extend the phase field model, the authors incorporated free energy density and non-local free energy density based on the Harrowel-Oxtoby and Gibbs-Landau theorems for polymer. Using the expansion principle for the higher order of the binary phase field parameter, they obtained the full modified phase field equation, and the rate of solidification was correlated with the melting temperature in a manner that was not straight forward.

The seventeenth paper, written by R. Kurnia and B.T. Sofyan, investigates the effect of cold rolling and annealing temperature on the recrystallization and mechanical properties of Al-4.7Zn-1.8Mg alloy fabricated by squeeze casting. The results showed that the higher was the deformation, the more elongated were the grains. Annealing at 300°C resulted in recovery, whereas annealing at 400°C resulted in recrystallization. Grain growth was observed after annealing at 500°C for 2 h. Annealing temperatures of 300°C, 400°C, and 500 °C decreased the hardness of the alloy from 105.4 VHN to 71.5, 96.8, and 95.3 VHN, respectively.

The eighteenth paper, written by A.H. Yuwono, T. Arini, L.H. Lalasari, N. Sofyan, G. Ramahdita, A. Nararya, F. Firdiyono, L. Andriyah, and A. Subhan, studies the effect of various precursors and solvents on the characteristics of fluorine-doped tin oxide conducting glass fabricated by

ultrasonic spray pyrolysis. The authors concluded that transparent conductive oxide (TCO) fabrication with tin chloride precursors and ammonium fluoride doping using ultrasonic spray pyrolysis can be considered a simple and low-cost method, as well as a breakthrough, in the manufacture of conductive and transparent glass.

The nineteenth paper, written by A.R. Destyanto, A. Hidayatno, and A. Amalia, presents a simulation of three alternative policy scenarios that can be applied by the Jakarta government to make the electricity production process efficient, which, in turn, can boost the economy and, at the same time, minimize CO_2 emissions. The authors suggested that the Jakarta government implement an efficient economic scenario for the first couple of years to boost the gross domestic regional product (GDRP) and then continue to implement a green scenario to reduce carbon emissions.

The twentieth paper, written by E. Muslim, I. Riansa, and Komarudin, analyzes the characteristics of a pairwise matrix when one of its elements is not available in the analytic hierarchy process. The authors concluded that a complete pairwise matrix that is consistent tended to have the same characteristics, viz. the priority sequence and the consistency index, when it had one missing value.

The twenty-first and last paper, written by D.S. Gabrieland A.W. Anindityo, proposes an integrated procedure and technique called brain-writing and interpretive process to support material value conservation in terms of the quality and quantity of plastic waste. The results suggested a new way of understanding who and how stakeholders support material value conservation practice, especially in the design and implementation process of plastic packaging.

We hope that this special edition of IJTech conveys some new insights into the way we conduct our research. We welcome any comments and inquiries you may have regarding the direction and content of IJTech.

With warmest regards from Jakarta,

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