ICOMEET 2021

https://icomeet.conference.unand.ac.id/
Email: icomeet@conference.unand.ac.id

ICOMEET Schedule for Invited Speaker

October 22th , 2021

To: Dr. Rianti Dewi Sulamet Ariobimo, ST, M.Eng., IPM.
Invited Speaker of ICOMEET

Dear Dr. Rianti,

We would like to inform you that the International Conference on Mechanical Engineering and Emerging Technologies (ICOMEET) will be held by hybrid meeting of online and offline (local participants) at November 3, 2021. The opening ceremony will be starting at 08.00 (Jakarta time). While parallel session will be started at 13.30. The tentative schedule can be seen in our website (http://icomeet.conference.unand.ac.id/conference-schedule). Each invited speaker will have time around 10 minutes for presenting the paper. The discussion will be opened to the audiences at the end of the speech for 5 minutes. We are very appreciating if you send us your presentation document (power point format) by using WhatsApp or Email before conference day.

We will use zoom platform for this conference. You can just click this link https://us02web.zoom.us/j/84185119179?pwd=a0h5WFI5NFB6RTdZUXJ5YzU5ejVWUT09 or join by using Meeting ID: 841 8511 9179, and Passcode: icomeet21

Thank you very much for your attention.

See you in the virtual online of ICOMEET 2021.

Best regards,

Gunawarman, Chair, ICOMEET 2021
Professor, Mechanical Engineering Department
Faculty of Engineering, Universitas Andalas
Kampus Limau Manis, Padang 25164, Indonesia
E-mail: gunawarman@eng.unand.ac.id
Mobile/WhatsApp: +6281374191227

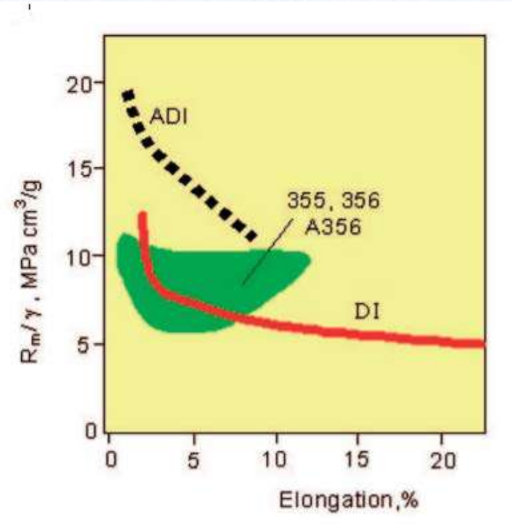
The Application of Thin Wall Ductile Iron Process in Connecting Rod

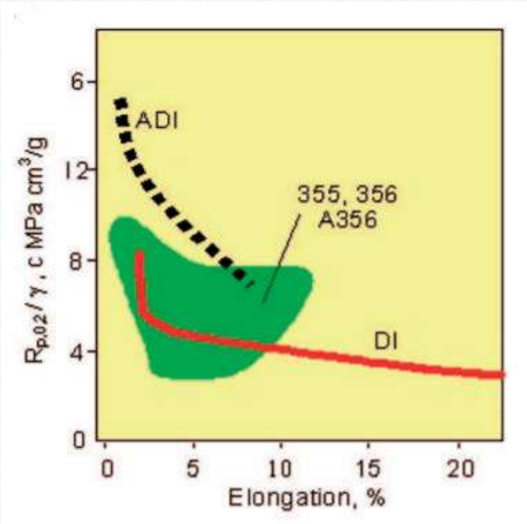
RD. Sulamet-Ariobimo, S. Aziza, M. Fadhlan,

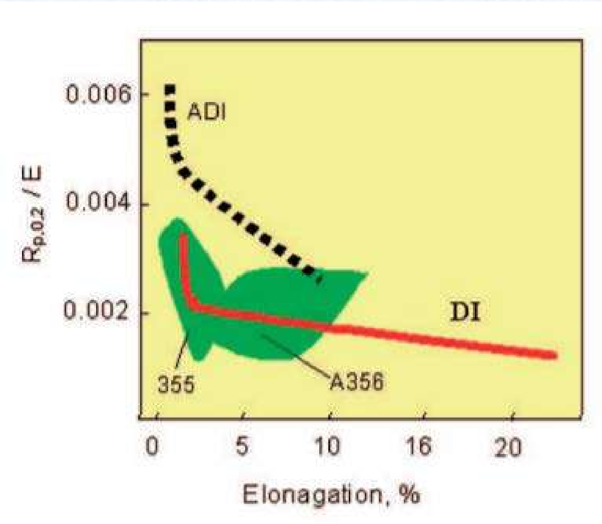
Y. Oktaviano and Y. Mujalis

INTRODUCTION

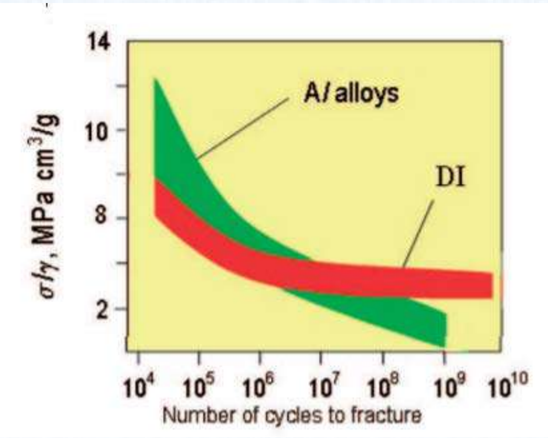
- Aluminium vs Cast Iron →

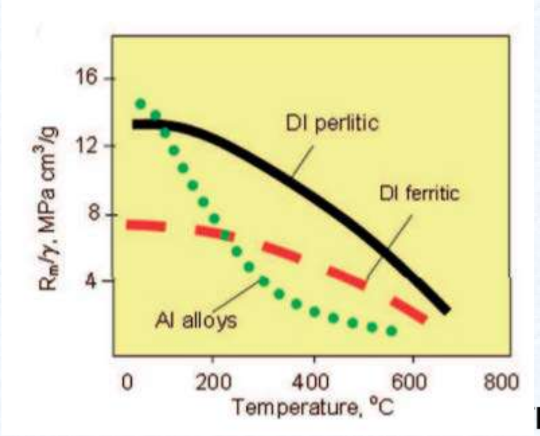


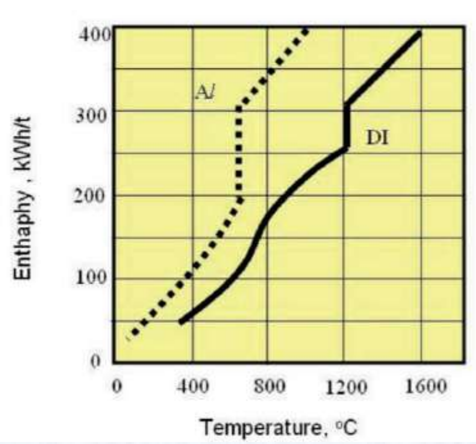




Material	Relative dumping capacity
Cast iron, thick graphite	100 - 500
Cast iron, fine graphite	20 -100
Ductile cast iron	5 -20
Steel	4
Aluminum	0.4



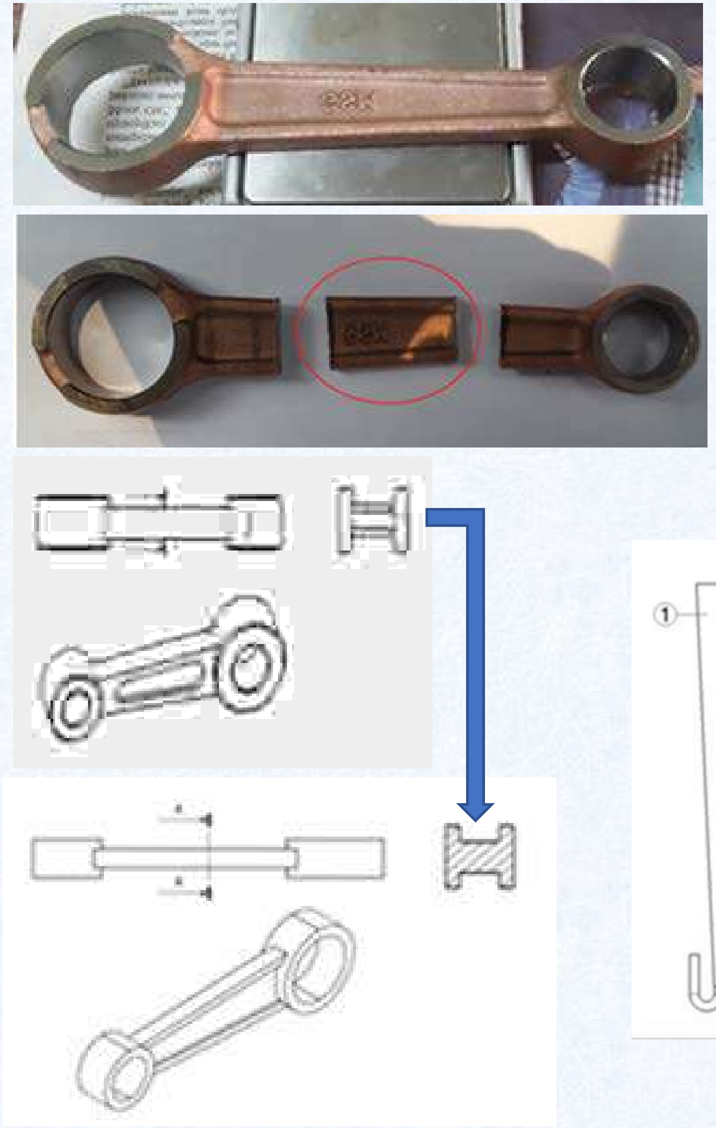


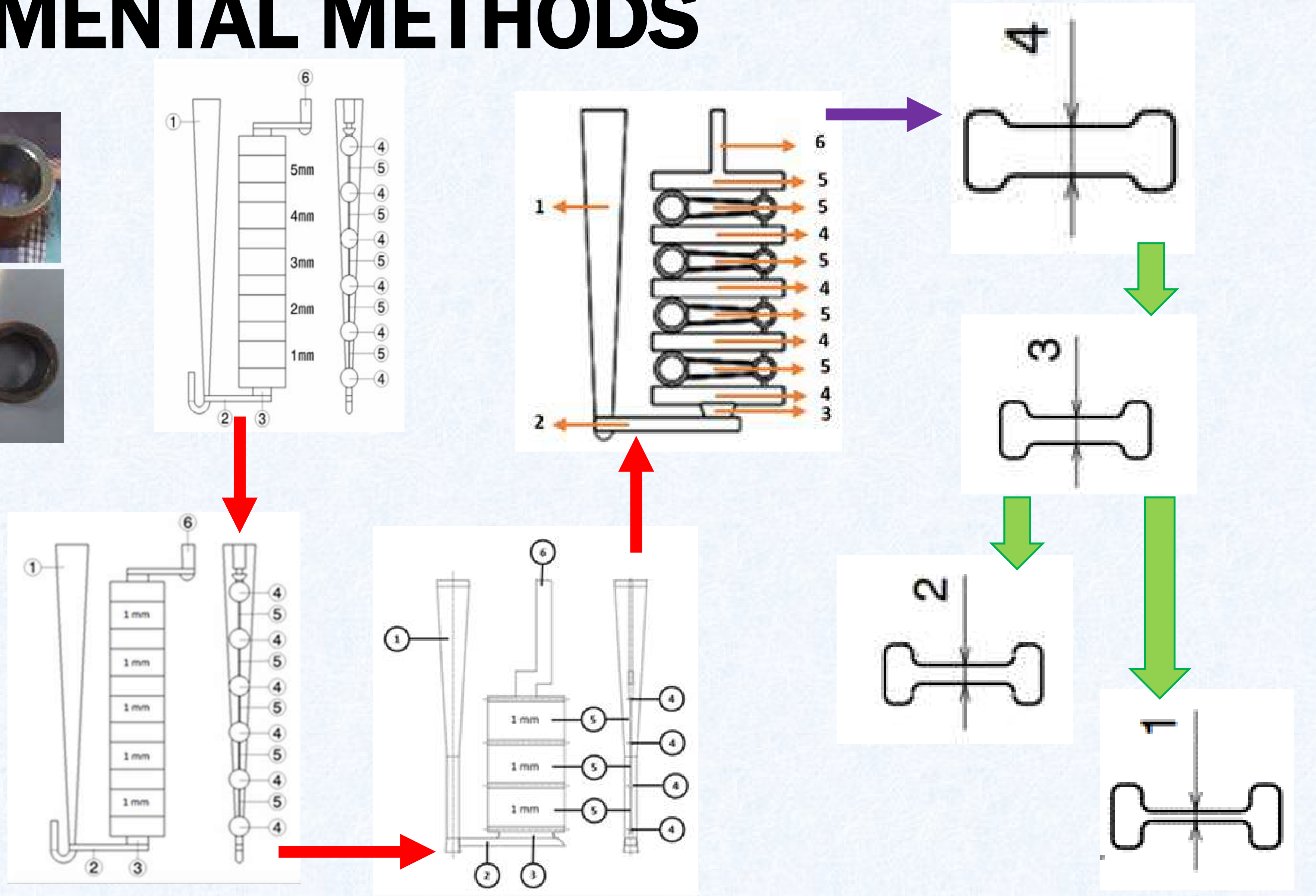


INTRODUCTION – 2

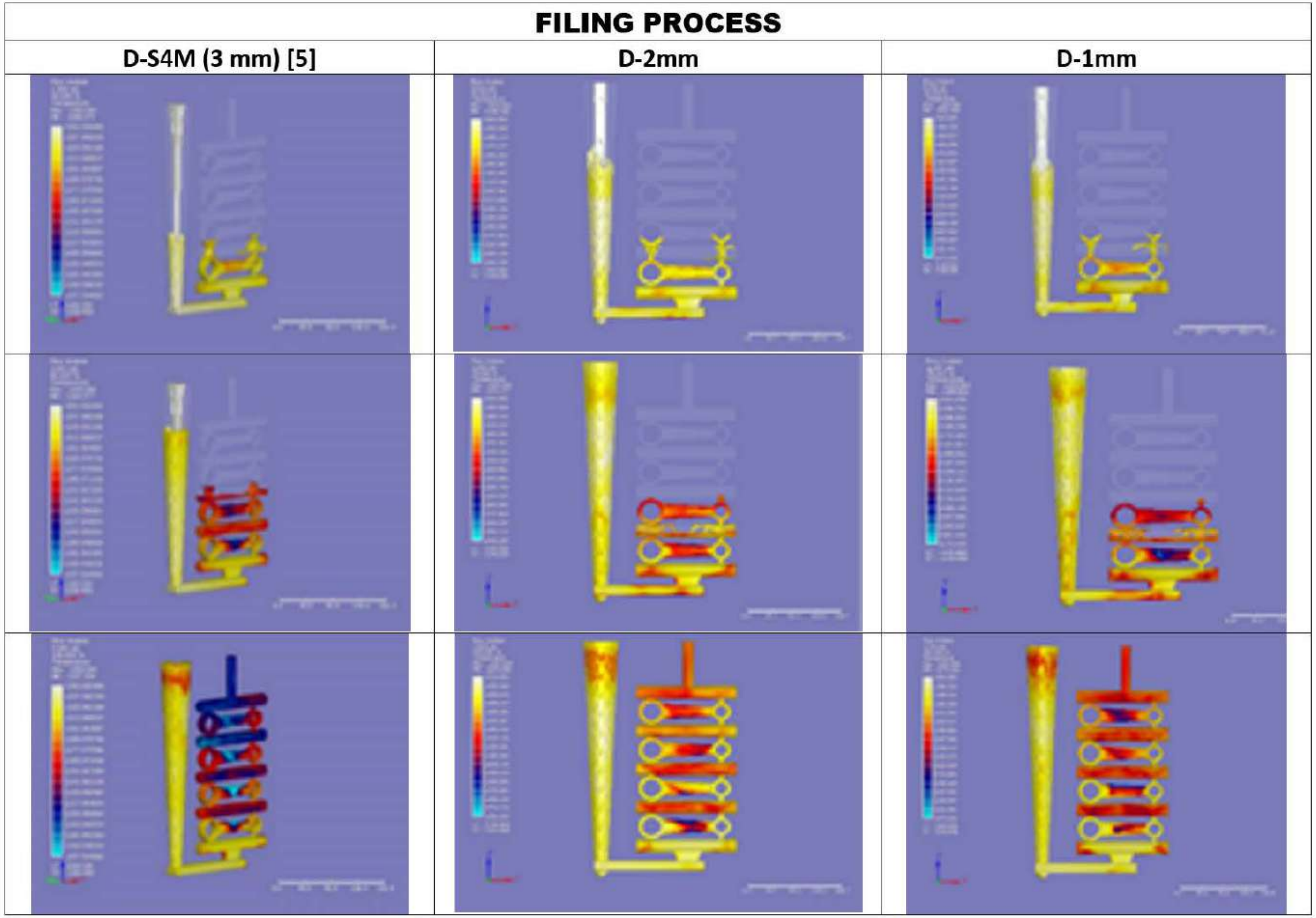
- Reduction – *simulation* 18.28 gr → 4 mm to 3 mm [SETC 2017]
- Reduction – *experimental* 36.00 gr → 4 mm to 3 mm [SETC 2017]

EXPERIMENTAL METHODS



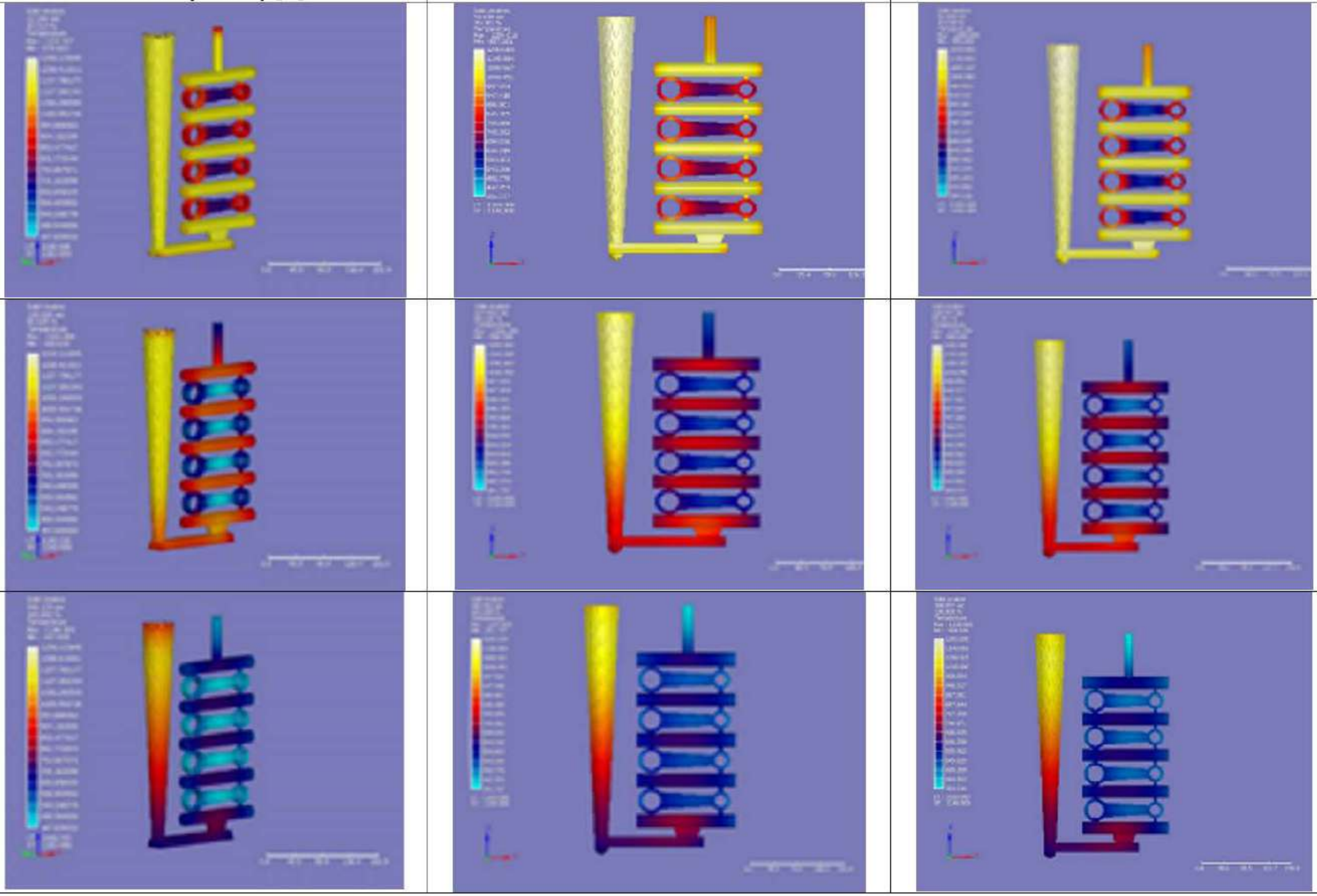


RESULT & DISCUSSION – 1(1)

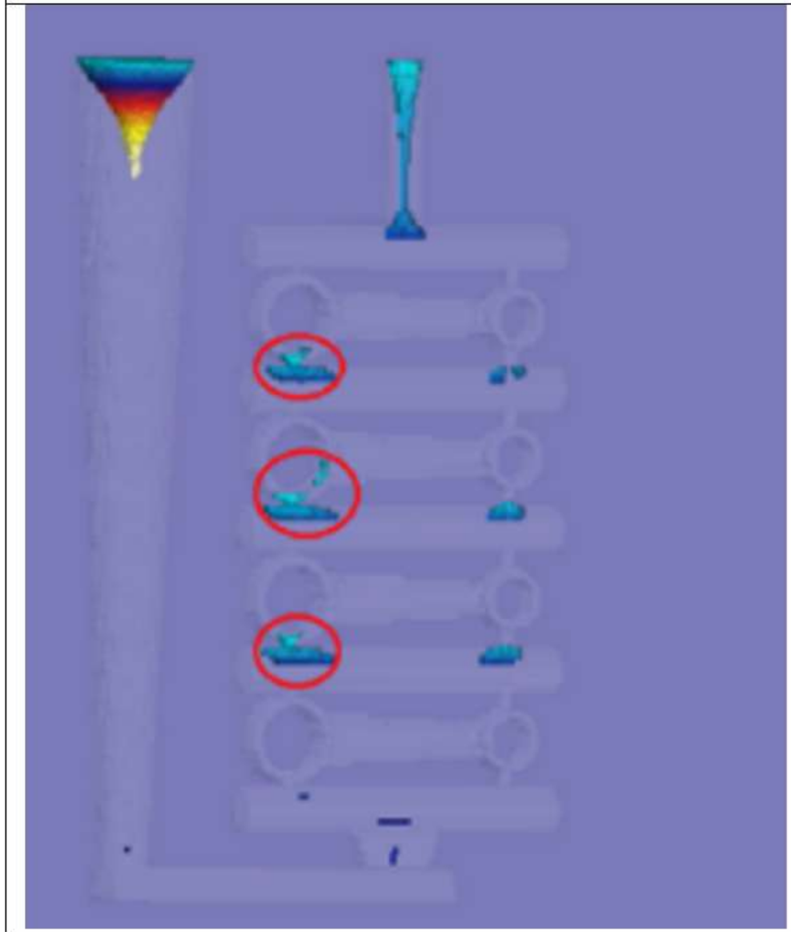
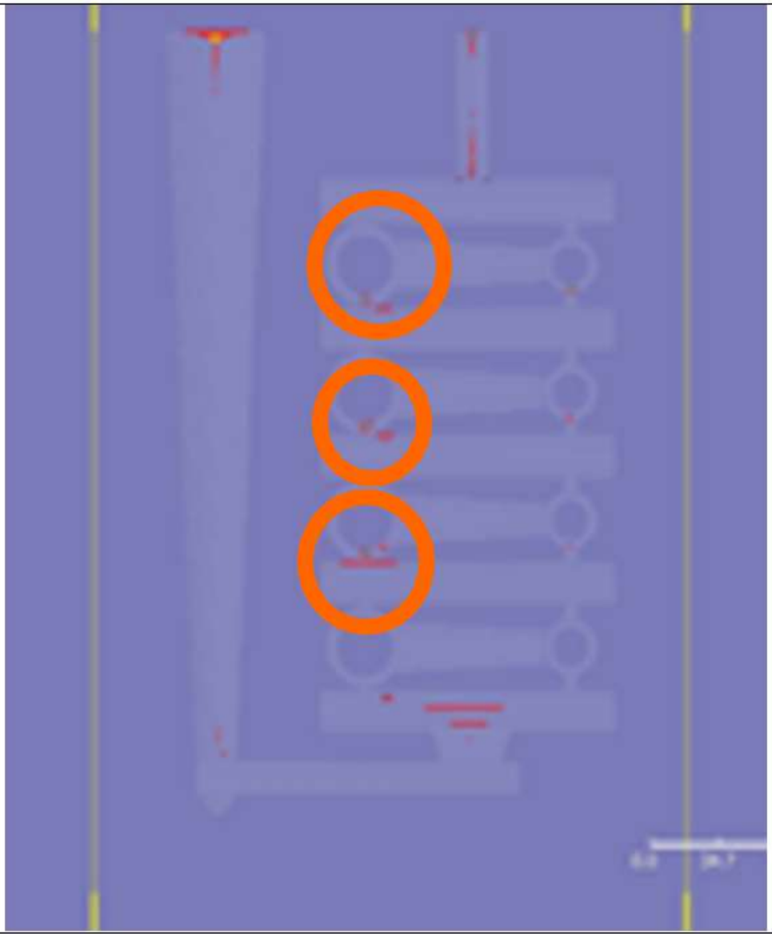
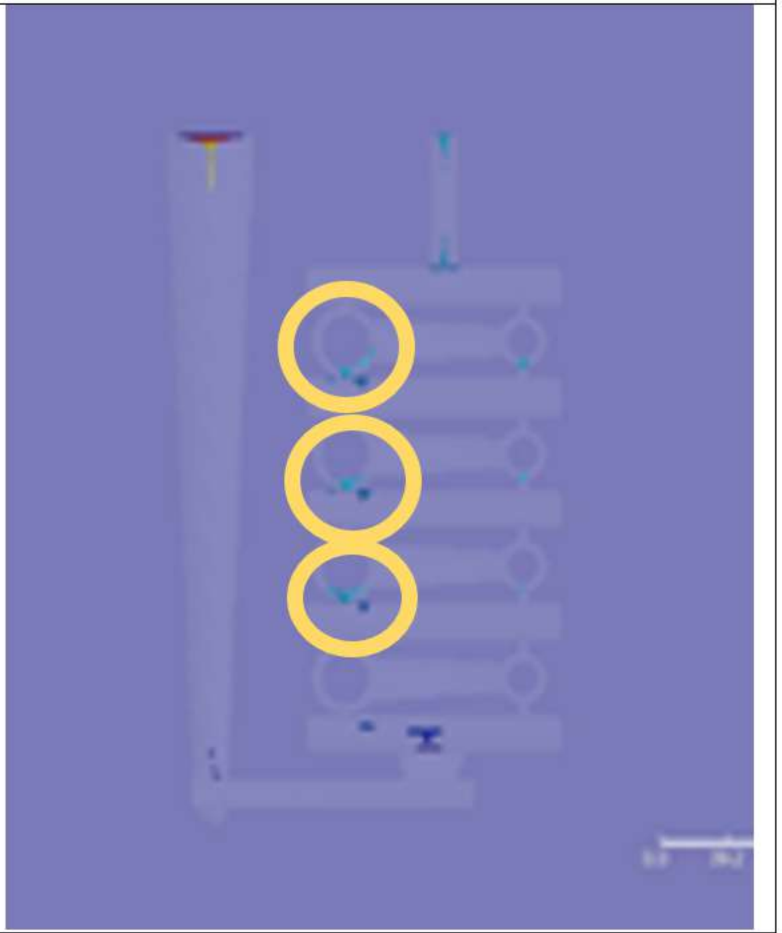


RESULT & DISCUSSION – 1(2)

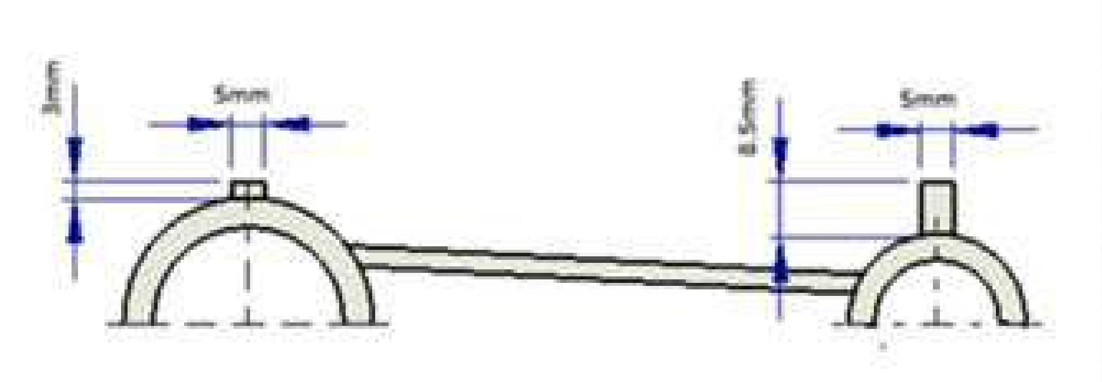
SOLIDIFICATION PROCESS		
D-S4M (3 mm) [5]	D-2mm	D-1mm



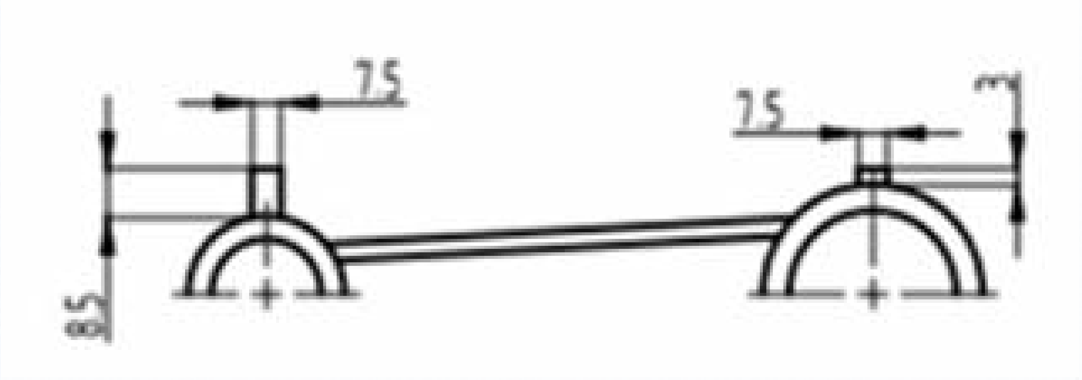
RESULT & DISCUSSION – 1(3)

SHRINGKAGE		
D-S4M (3 mm) [5]	D-2mm	D-1mm
		

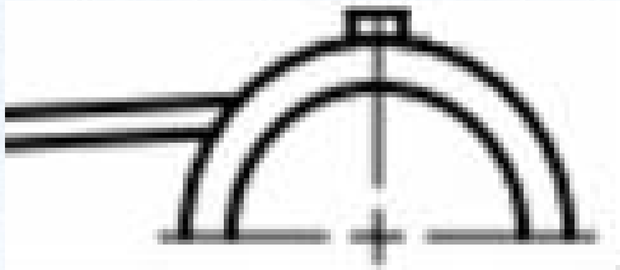
RESULT & DISCUSSION – 2



D-S4M



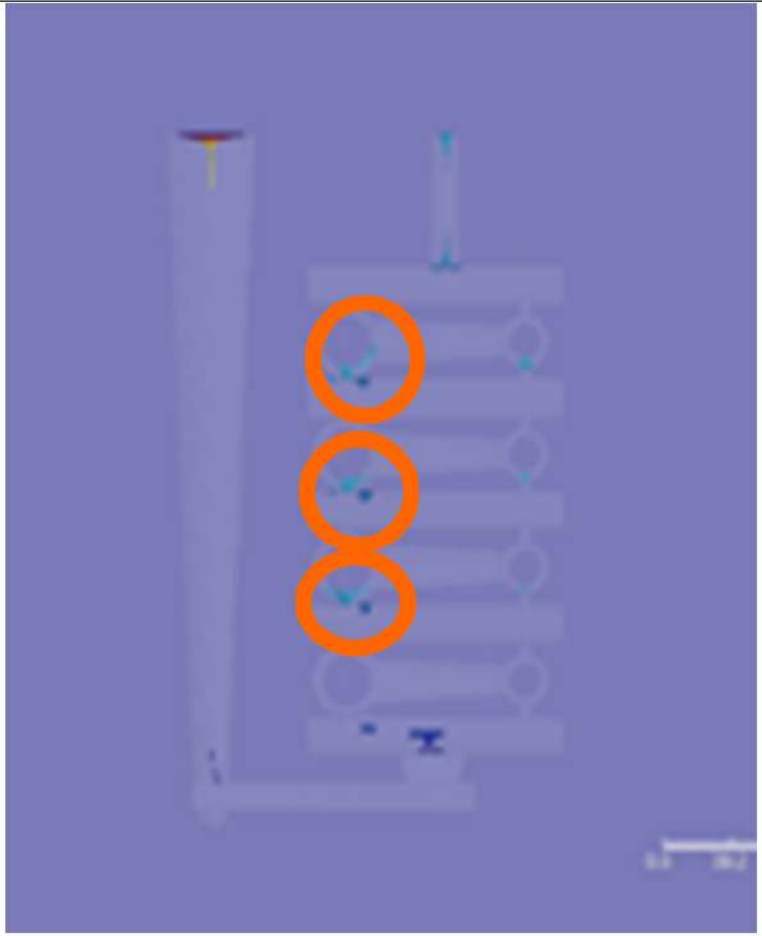
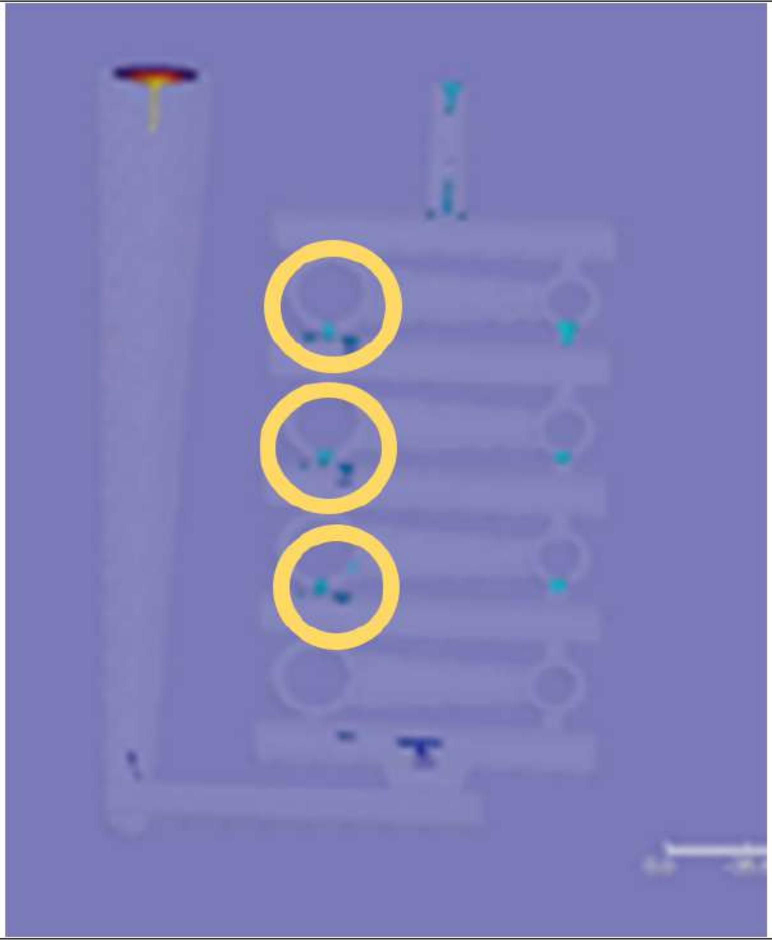
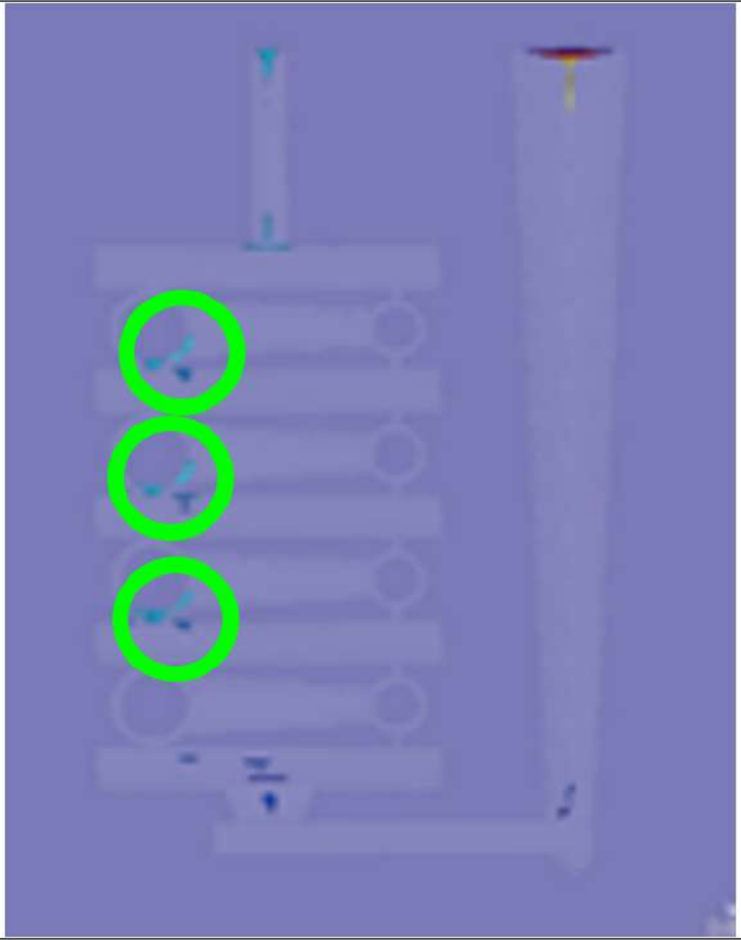
DM1-1mm



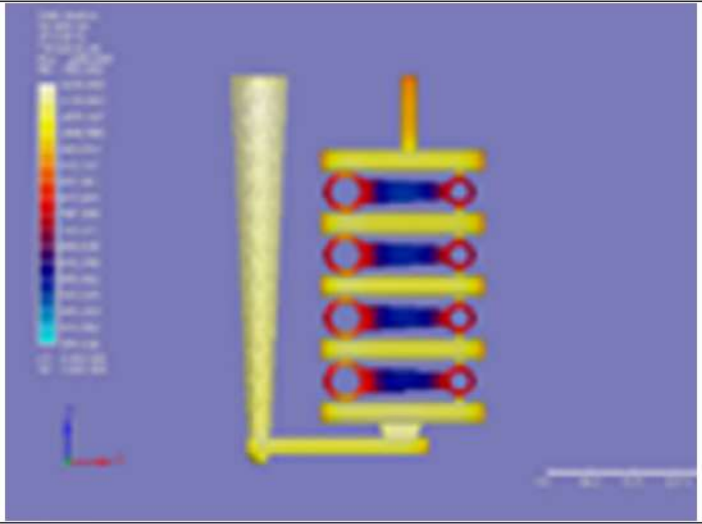
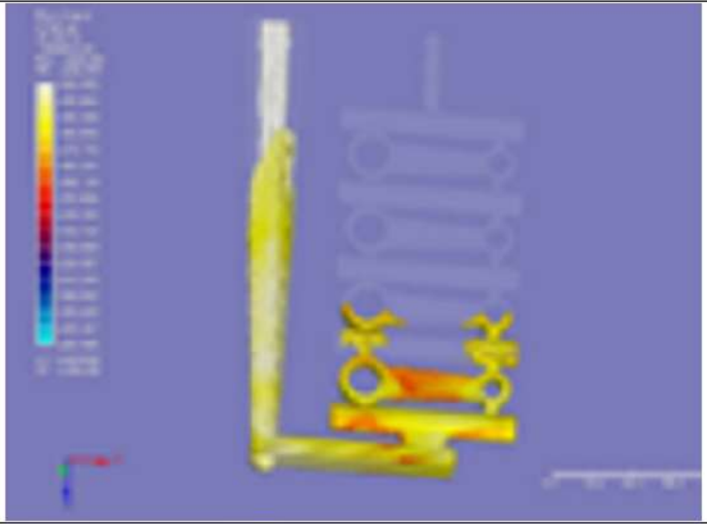
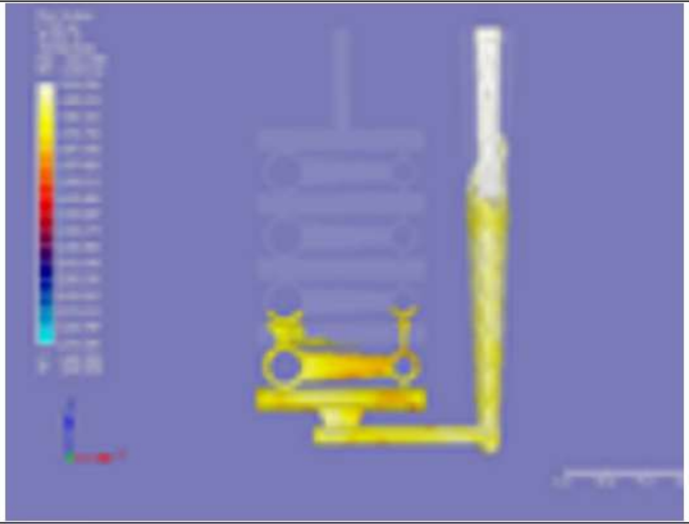
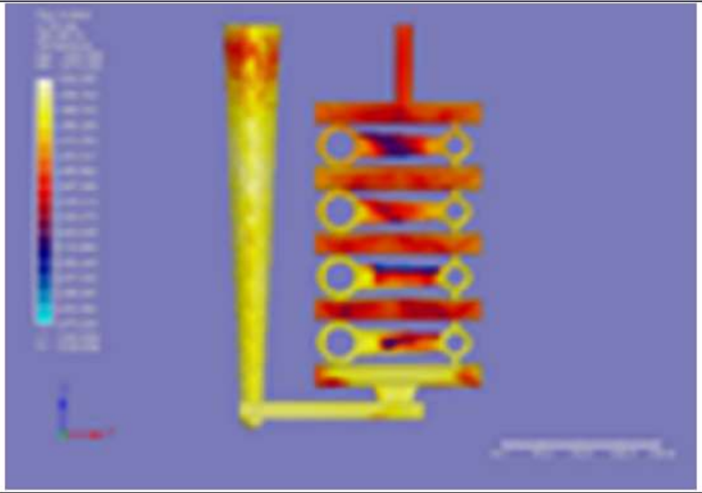
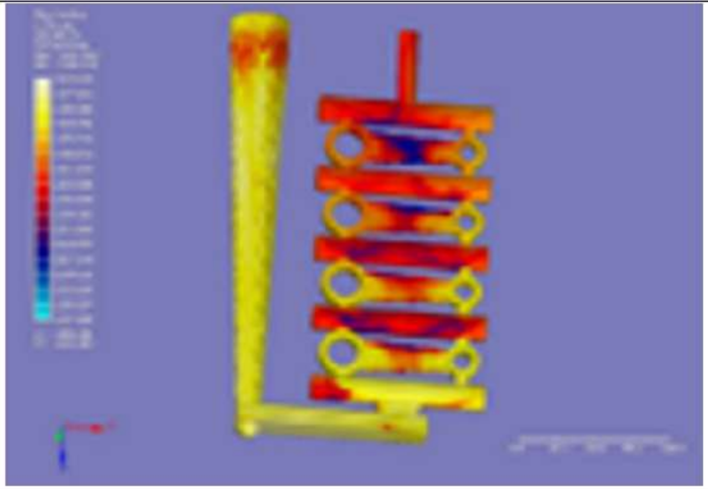
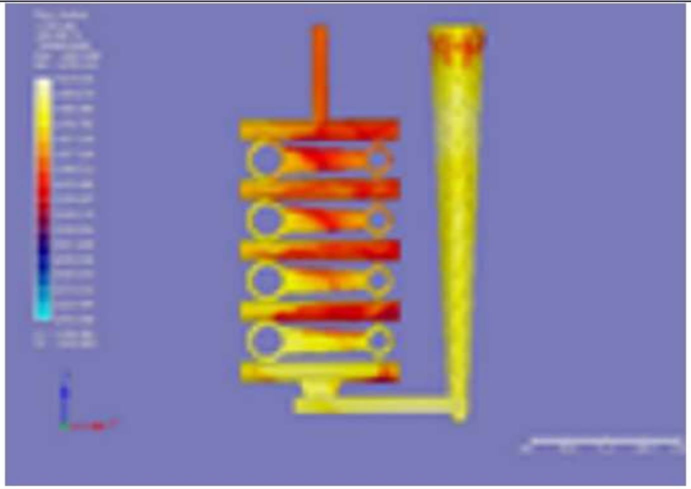
D-S4M

DM2-1mm

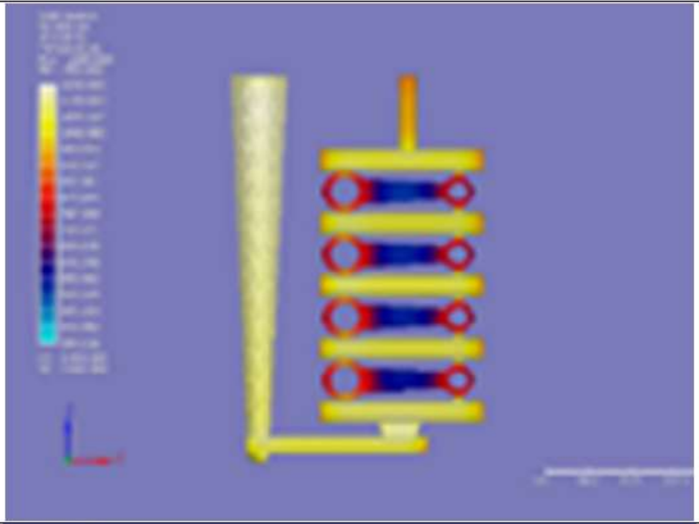
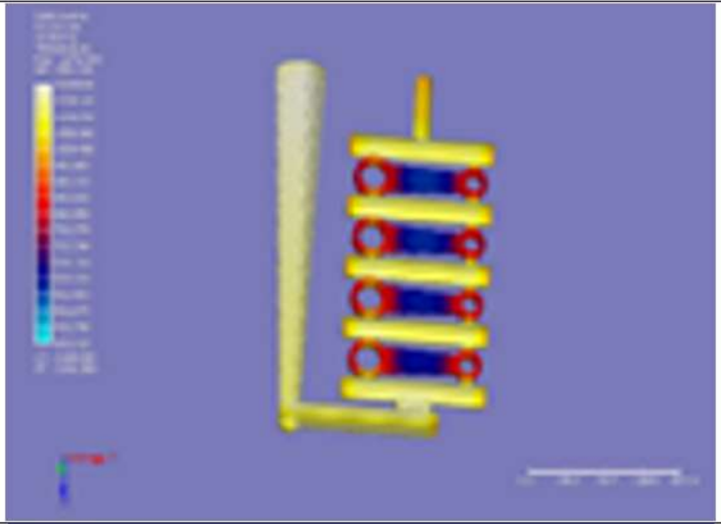
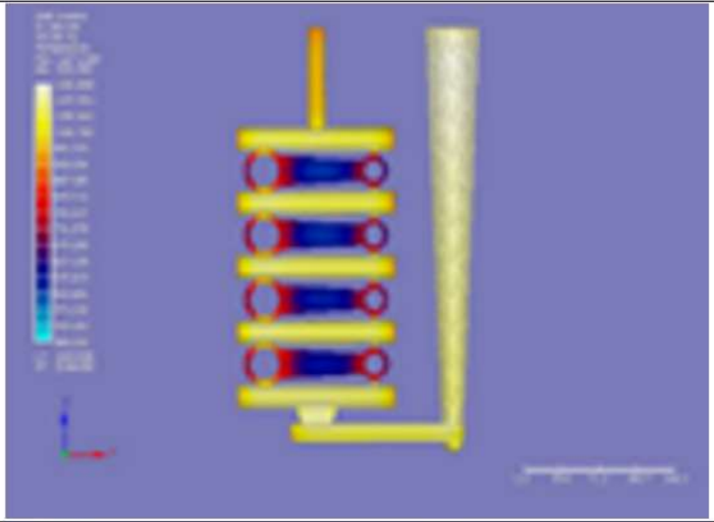
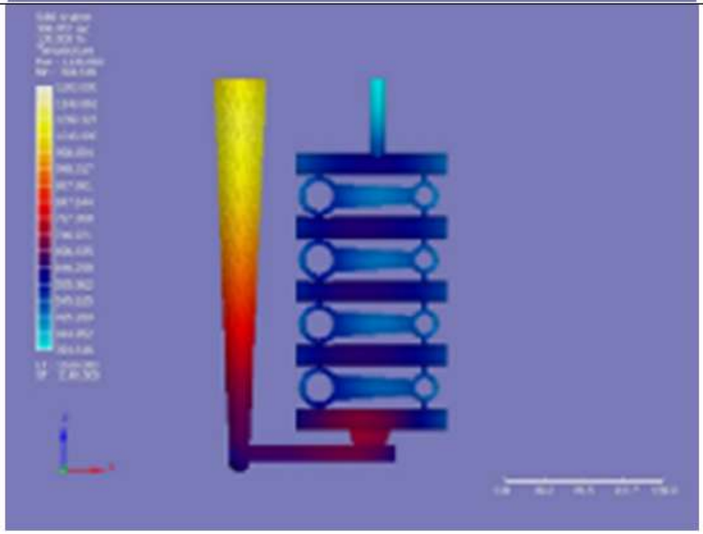
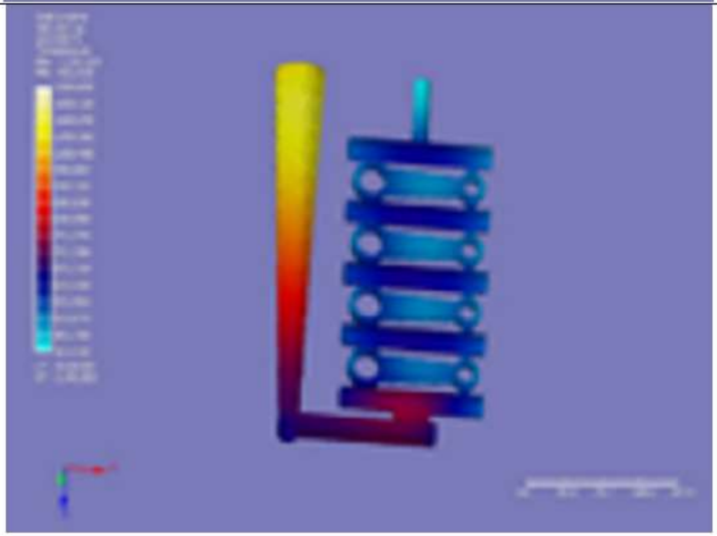
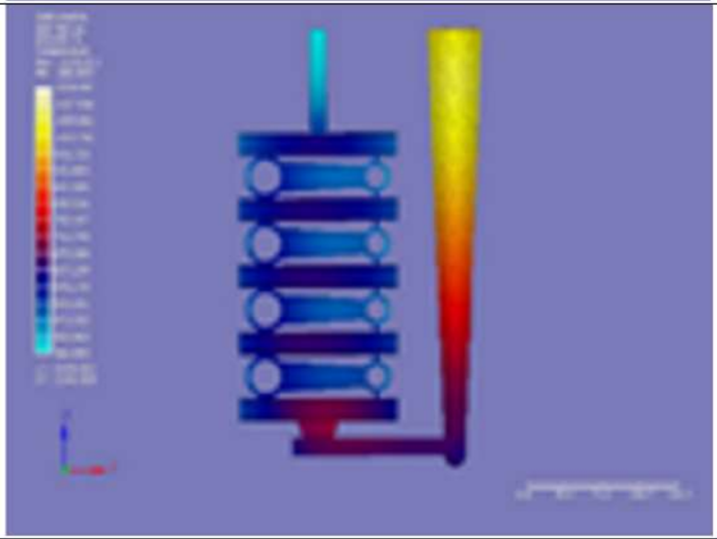
RESULT & DISCUSSION – 3(1)

SHRINGKAGE		
D-1mm	DM1-1mm	DM2-1mm
		

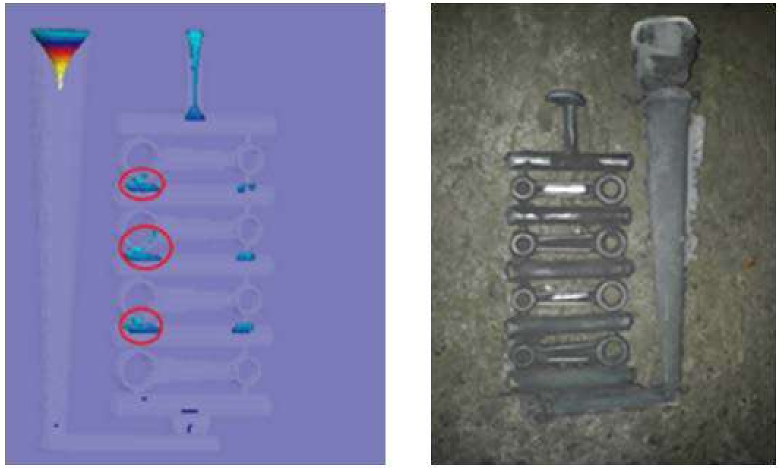
RESULT & DISCUSSION – 3(2)

FILLING PROCESS		
D-1mm	DM1-1mm	DM2-1mm
		
		

RESULT & DISCUSSION – 3(3)

SOLIDIFICATION PROCESS		
D-1mm	**DM1-1mm**	**DM2-1mm**
		
		

RESULT & DISCUSSION – 4



DS4M – 3 mm [5]

D – 2 mm

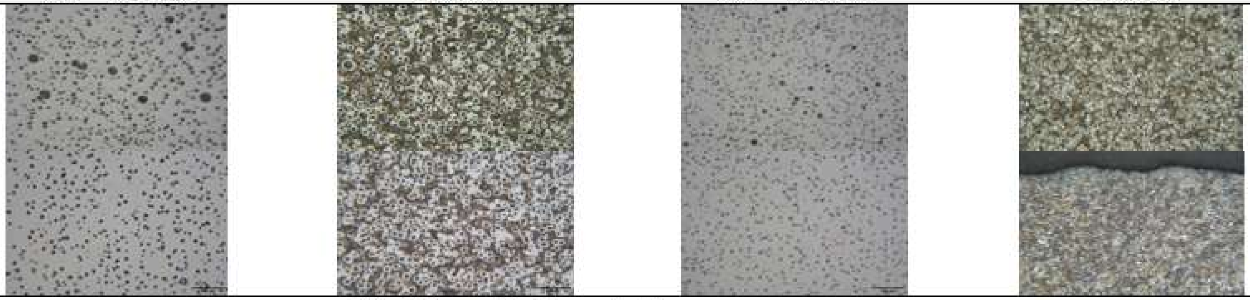
D – 1 mm

RESULT & DISCUSSION – 5

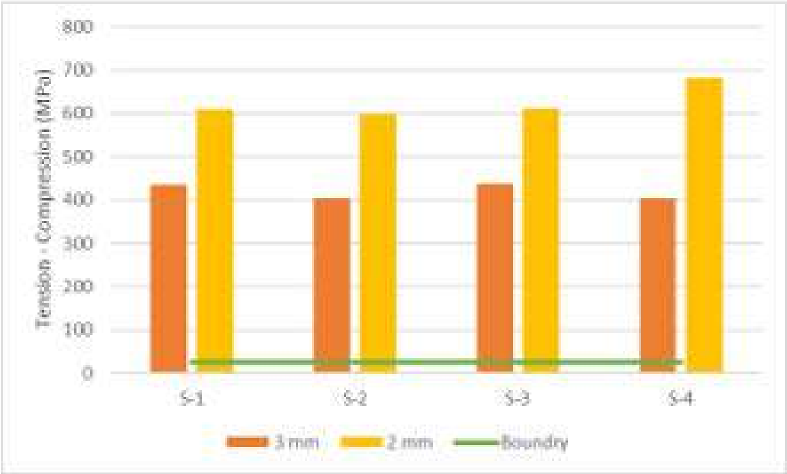
Table Chemical Composition of Liquid Metals

Chemical Composition		Standard ASM Handbook	Modified Connecting Rod – I-beam Area		
			3 mm [5]	2 and 1 -mm	
% Weight				Batch – 1	Batch – 2
Carbon	C	3.600 – 3.830	3.620	3.670	3.810
Silicon	Si	1.800 – 2.800	2.540	2.680	2.650
Manganese	Mn	0.150 – 1.000	0.420	0.440	0.400
Copper	Cu	0.015 – 1.000	0.230	0.270	0.190
Chromium	Cr	0.030 – 0.070	0.090	0.003	0.050
Nickel	Ni	0.050 – 2.000	0.007	0.001	0.010
Manganese	Mg	0.030 – 0.060	0.040	0.005	0.040
Phosphor	P	< 0.3000	0.020	0.001	0.010
Sulphur	S	< 0.020	0.020	0.002	0.010
Molybdenum	Mo	0.01 – 0.100	0,00	0.010	0.010
Carbon Equivalent	CE	4.59	4.47	4.37	4.70

I-beam thickness	Rod-end		I-beam	
	Un – etched	Etched	Un – etched	Etched
3 mm				
2 mm				



Metallography Examination



Compression Strength

CONCLUSION

- ✓ The thinnest I-Beam → 2 mm
- ✓ Casting Design I-Beam 3 mm → 2 mm
- ✓Simulation vs Experimental → done → fulfill requirement
- ✓Premature solidification → no → liquid metals
- ✓Smaller/thinner vs cooling rate


THANK YOU

ACKNOWLEDGMENT

The authors would like to show their gratitude to:

- Faculty of Industrial Technology Universitas Trisakti for the research grant.
- Department of Metallurgy and Material, Engineering Faculty Universitas Indonesia and KITECH – Korea for Z-Cast Simulation Software.
- PT. Geteka Founindo for producing the connecting rod prototype.

Wednesday, November 3rd, 2021 (all times in Indonesia Western Time / GMT+7:00)

Conference Schedule of ICOMEET 2021

Time	Activity	Speaker / PIC
07.30-08.00	Conference preparation. Participants join the online Conference platform (Zoom Meeting). **1. Welcome to West Sumatra (Video of tourist attractions in West Sumatra)** **2. Profile videos of Andalas University, Engineering Faculty and Mechanical Engineering Departments**	
08.00-08.40	*Opening Ceremony* 1. National Anthem: Indonesia Raya 2. Du'a 3. Welcome speech from Chairman ICOMEET 2021 4. Opening speech from Rector of Universitas Andalas	MC Prof. Dr. Eng. Gunawarman Vice Rector IV, Dr. Hefrizal Handra, M.Soc.
08.40-09.00	**SESSION BREAK**	*(Performing the minangkabau traditional dance)*
09.00-09.30	Keynote Speaker I: **Dental Implant Research** **Prof.Cortino Sukotjo, DDS, Ph.D** *University of Illinois, USA*	Moderator: Ismet Hari Mulyadi, Ph.D
09.30-10.00	**Discussion**	
10.00-10.30	Keynote Speaker II: **Prediction of Magnesium AZ91D Alloy Casting Properties Through Cooling Slope Approach** **Prof. Dr. Mohd. Hasbullah** *Universiti Teknologi Malaysia, Malaysia*	Moderator: Ismet Hari Mulyadi, Ph.D
10.30-11.00	**Discussion**	
11.00-11.30	Keynote Speaker III: **Development of Highly Efficient Carbon Capture Technologies Driven with a Low-Grade Heat** **Prof. Akio Kodama** *Kanazawa University, Japan*	Moderator: Dr. Eng. Meifal Rusli
11.30-12.00	**Discussion**	
12.00-12.30	Keynote Speaker IV: **Vibration Mitigation Using Multiple Dynamic Vibration Absorbers** **Assoc. Prof. Dr. Eng. Lovely Son** *Universitas Andalas, Indonesia*	Moderator: Dr. Eng. Meifal Rusli
12.30-13.00	**Discussion**	
13.00-13.30	**LUNCH BREAK**	*Rabab and Suliang Performance (The traditional music performance of West Sumatera)*
13.30-17.00	*Parallel Session 1 (Group A – Invited speaker, Assoc. Prof. Dr. Masrullizam Bin Mat)* *Moderator:Dedison Gasni PhD. Fasilitator: Dr. Eng. Ilhamdi*	
	Parallel Session 2 (Group B – Invited speaker, Prof. Mohammad Badaruddin, Ph.D) *Moderator:Dr.-Ing Jhon Malta, Fasilitator: Dr. Eng. Lovely Son*	
	Parallel Session 3 (Group C – Invited speaker, Dr. Rianti Dewi S. A, ST, M.Eng, IPM) *Moderator:Zulkifli Amin, PhD, Fasilitator: Dr. Oknovia Susanti*	

Wednesday, November 3rd, 2021 (all times in Indonesia Western Time / GMT+7:00)

Time	Activity	Speaker / PIC
	Parallel Session 4 (Group D – Invited speaker, Dr. Eng. Yusreni Warmi) *Moderator:Firman Ridwan, PhD, Fasilitator: Haznam Putra, MT*	
	Parallel Session 5 (Group E – Invited speaker, Dr.-Ing. Uyung Gatot S. Dinata) *Moderator:Dr.Adjar Pratoto, Fasilitator: Lega Putri Utami, MT*	
17.00 – 17.10	Announcement of ICOMEET Award 2021	MC
17.10 - end	Closing ceremony	Dean of Engineering Faculty

Zoom Meeting:
https://us02web.zoom.us/j/84185119179?pwd=a0h5WFI5NFB6RTdZUXJ5YzU5ejVWUT09
Meeting ID: 841 8511 9179
Passcode: icomeet21

PARALLEL SESSION SCHEDULE

WEDNESDAY, November 3rd 2021

THE ICOMEET 2021	:	EMERGING TECHNOLOGY
ROOM	:	BREAKOUT ROOM 1
TIME	:	13.30-17.00 WIB
SESSION CHAIR	:	DEDISON GASNI Ph. D
INVITED SPEAKER	:	ASSOC. PROF. DR. MASRULLIZAM BIN MAT
TITLE	:	AN ADAPTIVE NOISE CANCELLATION OF ECG SIGNAL FOR E- HEALTH APPLICATION

No.	PAPER CODE	TITLE	PAGE
1	1014	Development of Ankle-Foot Orthosis Using Servo Motor with On-Off Control System for Drop-Foot	
2	1034	Zirconium Oxide Contribution for Cracking Reduction of the Hydroxyapatite-Based Coating Layer on Ti-6AL-4V ELI Surface Through Dip-Coating Method	
3	1076	Image Pseudo-coloring for the Analysis of COVID-19 Using Chest X-Ray Images	
4	1095	The Influence of Thermal Oxidation on Hardness and Microstructure of Beta-Type Titanium alloy	
5	1020	Evaluation of Shipping Channel and Their Dredging at Fishery Port	
6	1042	Analysis of Air Ventilation System In The Engine Room Patrol Boat 60 Meters After Repowering	
7	1047	Modelling of 3 Axis Direction Motorcycle Parking System with Micro Controller ATmega2560	
8	1056	A New Geometric Planning Approach for Railroads Based on Satellite Imagery	
9	1084	Measurement of Railway Ballast Deficiency Using UAV Drone and Total Station by Graphical, Statistical, and Volume Comparison	
10	1012	Early Warning Speed Contactless Design for Motorcycle with Microcontroller for Eco and Smart Driving Applications	
11	1013	Contactless Tachometer Design for 4 Stroke CDI Ignition Motorcycle with Microcontroller for Smart Rpm Measurement	
12	1018	The Application of Integrated Production Modelling to	

WEDNESDAY, November 3rd 2021

WEDNESDAY, November 3rd 2021

THE ICOMEET 2021	:	MANUFACTURING & INDUSTRIES
ROOM	:	BREAKOUT ROOM 2
TIME	:	13.30-17.00 WIB
SESSION CHAIR	:	DR. ING. JHON MALTA
INVITED SPEAKER	:	PROF. MOHAMMAD BADARUDDIN, S.T, M.T, PH.D
TITLE	:	EFFECT OF SINGLE AND DOUBLE QUENCHING AND TEMPERING HEAT TREATMENTS ON MICROSTRUCTURES AND TENSILE STRENGTH OF AISI 4140 IN ANNEALING CONDITION

No.	PAPER CODE	TITLE	PAGE
1	1009	Stress Analysis of Amphibian Float Compartment Using Finite Element	
2	1010	Increasing Hardness of Segment Teeth Undercarriage Dozer D155-5 Component Based on Induction Quenching Tempering	
3	1030	Investigation Of Mechanical And Physical Properties Of Continue Drive Welding On Aluminum Alloy (AA6061)	
4	1038	Robust Parameter Design of Shield Metal Arc Welding (SMAW) for Optimum Tensile Strength Using Response Surface Method	
5	1039	Parameter Optimization of Injection Molding Polypropylene to Minimize Shrinkage Using Taguchi Method	
6	1052	Frequency Response Function (FRF) Prediction on Tool-Holder and Tool of spindle system Using Receptance Coupling Sub-Structure Analysis (RCSA) and Timoshenko Beam Method	
7	1072	The Initial Study on the Preparation of Sansevieria Fiber - Natural Rubber Green Composite	
8	1078	Influence of Quenchant Variations Solution Treatment and Holding Time Artificial Aging on Microstructure and Hardness of Cu-Zn-Al Alloys in Shape Memory Alloy Materials	

WEDNESDAY, November 3rd 2021

WEDNESDAY, November 3rd 2021

THE ICOMEET 2021 : MATERIAL

: BREAKOUT ROOM 3

ROOM

TIME : 13.30-17.00 WIB

SESSION CHAIR : ZULKIFLI AMIN Ph. D

INVITED SPEAKER : DR. RIANTI DEWI SULAMET ARIOBIMO, ST, M.ENG, IPM

TITLE : THE APPLICATION OF THIN WALL DUCTILE IRON PROCESS IN CONNECTING ROD

No.	PAPER CODE	TITLE	PAGE
1	1002	Electrical properties of Bacterial Cellulose-polypyrrole biocomposite without and with the withdrawal	
2	1006	Effect of Post-Curing treatment to Combine Loading Compression Test of Carbon-Epoxy Composite	
3	1007	The Effect of Percentage Binder on Fiber Bio-briquettes EFB on Ignition Quality	
4	1008	Improvement of the Mechanical Properties of RHA-based Silica with the Addition of Alumina Powder as a Reinforcing Material	
5	1015	Changes in Electries Properties of Composite Film Caused by Variation of Humidity	
6	1017	Surfactants Synthesized from Bagasse as Advanced Materials for Enhanced Oil Recovery	
7	1019	Simulation of Vertical Load Bearing Capability of Composite Sandwich Core Geometry Using AA3003 Aluminum Properties	
8	1021	Dissolution of Ferrous Into Molten of Aluminum-Copper	
9	1029	Effect of Surface Morphology on Resistivity of Zinc Oxide Thin Layer	
10	1032	Comparison of Short Beam Strength and In-Plane Shear Values in Twill Carbon Fiber Composites with Vinyl Ester and Crestapol Resin Using Vacuum Infusion Method as Material Candidate for Float N219 Amphibious Aircraft	
11	1046	Macrostructural and Mechanical Properties of Rails	

WEDNESDAY, November 3rd 2021

No.	PAPER CODE	TITLE	PAGE
		Cladded by Automatic Flame Treatment	
12	1049	Contribution of Hydroxyapatite Layer on Corrosion and Bioactivity Properties of Ti-12Cr in Simulated Body Fluid	
13	1062	Influence of Heat Treatment on Microstructures and Shape Memory Effect of Cu-28Zn-2.5Al wt. % Produced by Gravity Casting	
14	1069	Effect of Preheating on Mechanical Properties and Corrosion Behavior of Dissimilar GMAW Joints Between Austenitic Stainless Steel and Low Carbon Steel	
15	1074	Tensile Properties and Weather-Resistance of Bisphenol-A-Epichlorohydrin Epoxy Resins: The Effect of Acetone as a Solvent	
16	1075	Functional Groups and Moisture Absorption of Palm Oil Empty Fruit Bunch Fibers/Tapioca Starch Biocomposite Film	
17	1086	The effect of heating surface treatment by oxy-acetylene gas on the microstructure and hardness of the UIC R42 rail	
18	1087	HDPE Plastic Waste Shredding Performance against High Quality Concrete	
19	1089	Utilization of plastic Waste as Asphalt Modification for AC-WC Mixture (Asphalt Concrete Wearing Course)	
20	1091	Study of effect time alkalization on extraction of cellulose of areca leaf sheath fiber (areca catechu)	
21	1004	Fracture Toughness of Thermoset Polyester Via Mixing with Thermoset Vinyl Ester and Methyl Methacrylate	
22	1098	Effect of Titanium Dioxide Thickness on Performance of Dye Sensitized Solar Cell Red Dragon Fruit	
23	1111	Mechanical Properties and Microstructure of Mg-1.6Gd Alloys Reduction 80% Hot Rolling As Implant Materials	

WEDNESDAY, November 3rd 2021

THE ICOMEET 2021	:	ELECTRICAL & INFORMATICS
ROOM	:	BREAKOUT ROOM 4
TIME	:	13.30-17.00 WIB
SESSION CHAIR	:	FIRMAN RIDWAN Ph. D
INVITED SPEAKER	:	Dr. Eng. YUSRENI WARMI
TITLE	:	INVESTIGATION INTO THE EFFECT OF TOWER FOOTING RESISTANCE ON THE LIGHTNING TRIP-OUTS OF 150 KV TRANSMISSION LINES IN THE ROCKY AREAS IN WEST SUMATRA IN INDONESIA

No.	PAPER CODE	TITLE	PAGE
1	1001	Comparison of the Design of Electric Motorcycles with Fossil Fuels and Hybrid Systems on 150Cc Motorcycles	
2	1005	Mobile Robot For Handling COVID-19 Corpse	
3	1011	Effect of Surge Arrester Lead Length on 20kV Distribution Transformer Protection	
4	1025	Grid Connection Feasibility Analysis of 5 MW Waste-to-Energy Power Plant in Surakarta, Indonesia	
5	1026	The Use of Shorting Pins in Bandwidth Enhancement of Circular Patch Antenna	
6	1044	Bandwidth Enhancement of Microstrip Slit Rectangular Patch Antenna fed by Proximity Coupled	
7	1051	Simulation of Early Warning System in Landslides and Flooding with IoT	
8	1058	Analysis of the Influence of Soil Resistivity on Back Flashover for the 150 kV Payakumbuh – Koto Panjang Transmission Line Tower	
9	1063	Instantaneous Frequency of Ground and Cloud Flash Radiations at Very High Frequency Narrowband System	
10	1064	Time-Frequency Analysis of Negative and Positive Ground Flash Radiations at Very High Frequency Narrowband System	
11	1065	Smart Energy Harvesting Using Portable Pelton Turbine with IoT Data Feedback for Rural Area Application	

WEDNESDAY, November 3rd 2021

No.	PAPER CODE	TITLE	PAGE
12	1066	Smart Energy Meter Based On Internet of Things (IoT)	
13	1067	Analysis of the Effect of Phase Ware Position Upper, Middle, and Lower against Distraction Back Flashover at Transmission Line 150 kV Koto Panjang – Payakumbuh	
14	1068	Electrical Thunderstorm Characteristics Associated with Lightning Activities in Padang	
15	1070	Data Acquisition Information System, on Electrical Tracking of Insulation Materials with Borland Delphi Software	
16	1071	Lightning Activity Characteristics Based on Atmospheric Electric Field Data in Padang	
17	1092	Discharge Initiation Processes of Tropical Lightning Flashes	
18	1035	Semi Supervised Classification for Forest Turn Over Analysis in South Bukit Barisan Area	
19	1053	The System of Title Similarity Detector on Submission of Final Project	
20	1059	Analysis of The Effect of Frequency Bandwidth Use on Frequency Division Duplex Technology on Long Term Evolution (LTE) Networks	
21	1060	The Information System Design of Covid-19 Swab Data Web Based at Medical Faculty Laboratory of Andalas University	
22	1061	The Design and The Construction of Management Information System in Tahfidz Shohibul Qur'an Pandai Sikek House Using Codeigniter Framework (Santri Section)	
23	1096	Fatigue Warning System During Physical Exercise Based on Heart Rate and Oxygen Saturation Using Android and Non-invasive Wearable Sensor	

WEDNESDAY, November 3rd 2021

THE ICOMEET 2021	:	ENERGY
ROOM	:	BREAKOUTROOM 5
TIME	:	13.30-17.00 WIB
SESSION CHAIR	:	DR. ADJAR PRATOTO
INVITED SPEAKER	:	DR. ING. UYUNG GATOT S. DINATA
TITLE	:	WIND TUNNEL TESTING FOR MEASURING LIFT AND DRAG COEFFICIENTS OF AN UNMANNED AERIAL VEHICLE MODEL WITH VARIATION OF THE ANGLES OF ATTACK

No.	PAPER CODE	TITLE	PAGE
1	1016	Primary Air Coal Supply Speed Analysis to Prevent Refractory Furnace Abrasion Using CFD Method at Tenayan Steam Power Plant	
2	1024	Parachute Design for Payload on LSU02 VTOL Aircraft	
3	1036	Characteristic Modification of Aerodynamic Forces Acting on Tandem Cylinder by Placing An I-65o Type Distracting Cylinder	
4	1055	Effect of Changes in Flap Deflection and Addition of Slat Clearance on Aerodynamic Performance of the Wing Airfoil NACA 43018 in the Cruising and Landing Phases	
5	1027	Simulation of Adsorption Coke Oven Gas (COG) from Steel Processing Plant to Produce High Purity Hydrogen	
6	1023	Study on Hybrid Renewable Energy Optimization in Mentawai Island using HOMER Pro	
7	1048	Evaluation of KOH Activator Concentration Variation on The Physical Properties of Super capacitor Electrodes from Activated Carbon of Cocoa Pods	
8	1073	Analysis about Implementation of Pico-Hydro Circulation System as Renewable Energy With Low Head	
9	1082	Machine Learning Approach for Prediction Model on Biomass Characteristic Analysis	
10	1088	Thermal Energy Storage Characteristics of Paraffin in Solar Water Heating Systems with Flat Plate Collectors	
11	1094	An experimental investigation on performance analysis of PV/T-TEC collector	
12	1101	Influence of EPD Micro-nano Hydroxyapatite Layer	

WEDNESDAY, November 3rd 2021

No.	PAPER CODE	TITLE	PAGE
		on Ti-6Al-4V ELI when Implanted	
13	1102	The influence of Temperature on Green Synthesis of Honey-Mediated Silver Nano Particles.	
14	1103	Effect of Spindle Speed, Feed rate, Tool Geometry, and Polyester & Vinyl ester Blends on Hardness Alteration and Roughness of the Hole Surface	
15	1104	Software Engineering Development of Finite Element Method Programming Applications in 2D Truss Structures Using Python Programs	
16	1106	Synthesis and Characterization of Nano cellulose/ TiO2 Nanocomposite As Catalyst of Conversion Fructose to 5-hydroxymethylfurfural	
17	1108	The Effectiveness Integration of PLS-SEM-Web Application to Assess Career Decision Self-Efficacy, Entrepreneurial Self-Efficacy and Career Future Perspective Time	
18	1109	Analysis of the Effect of Alkalization Treatment on Mechanical Strength of Rice Straw-Epoxy Fiber Composites	
19	1110	Hardener Composition Role on Mechanical Properties of Polyester and Lycal Resin	
20	1112	Identification of Rare Earth Element (REE) from Granite, Basalt, Clay, Silica, Tuff, and Limestone at West Sumatera Hills	
21	1114	Coconut Shell Gasification Stove Test with Variation of Air Flow Rates	
22	1115	Wind Tunnel Experiment on a Horizontal Axis Wind Turbine Model with Magnus Effect	

INTERNATIONAL CONFERENCE ON MECHANICAL ENGINEERING FOR EMERGING TECHNOLOGIES (ICOMEET) 2021

Online conference on November 3-4, 2021, Padang - Indonesia

INVOICE

TO : Rianti Dewi Sulamet-Ariobimo, Siti Aziza, Mohammad Fadhlan Yoska Oktaviano, Yusep Mujalis	Number : 79/INV/ICO/2021 Date : 21st Sept 2021 Currency : RUPIAH

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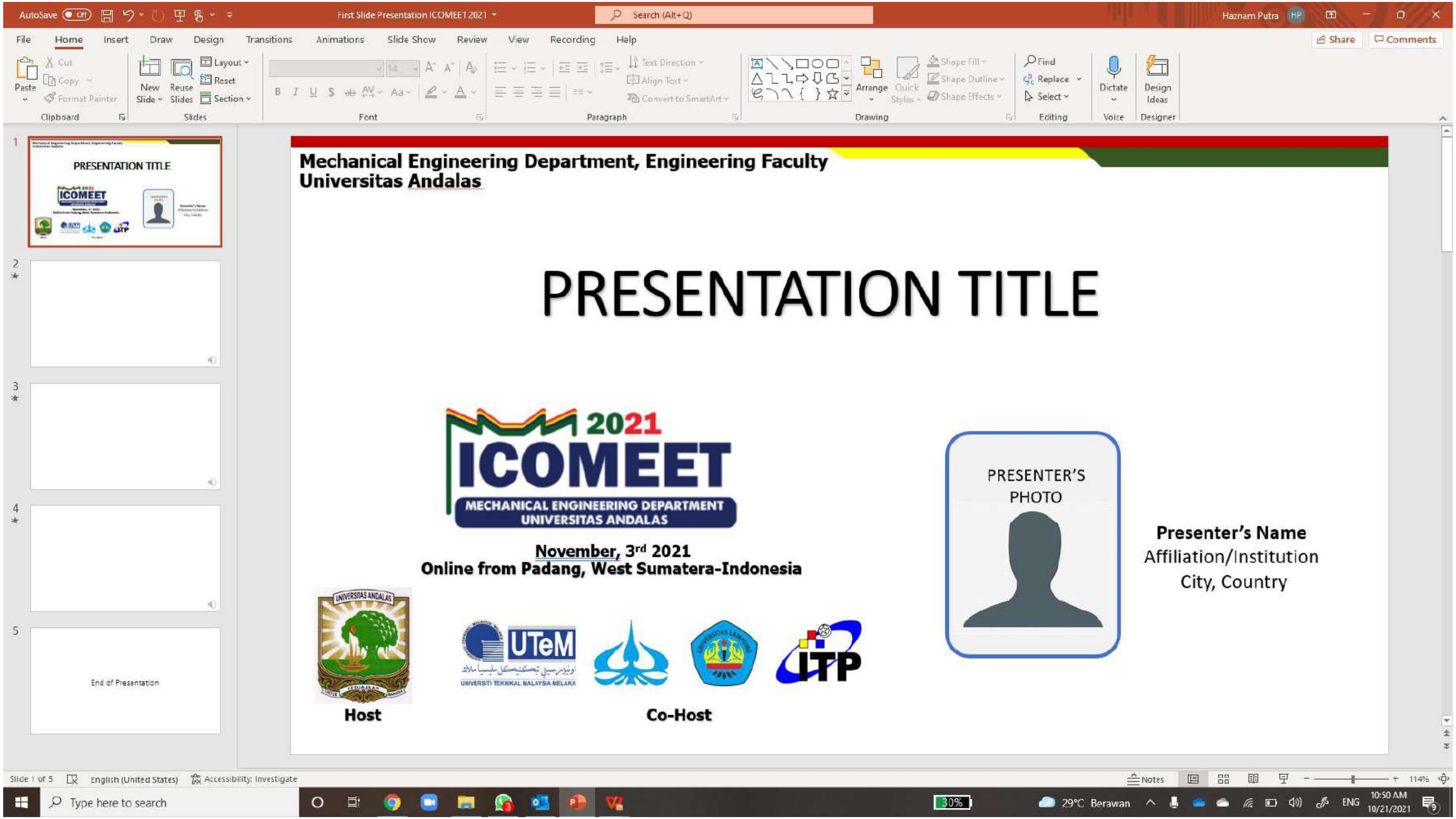
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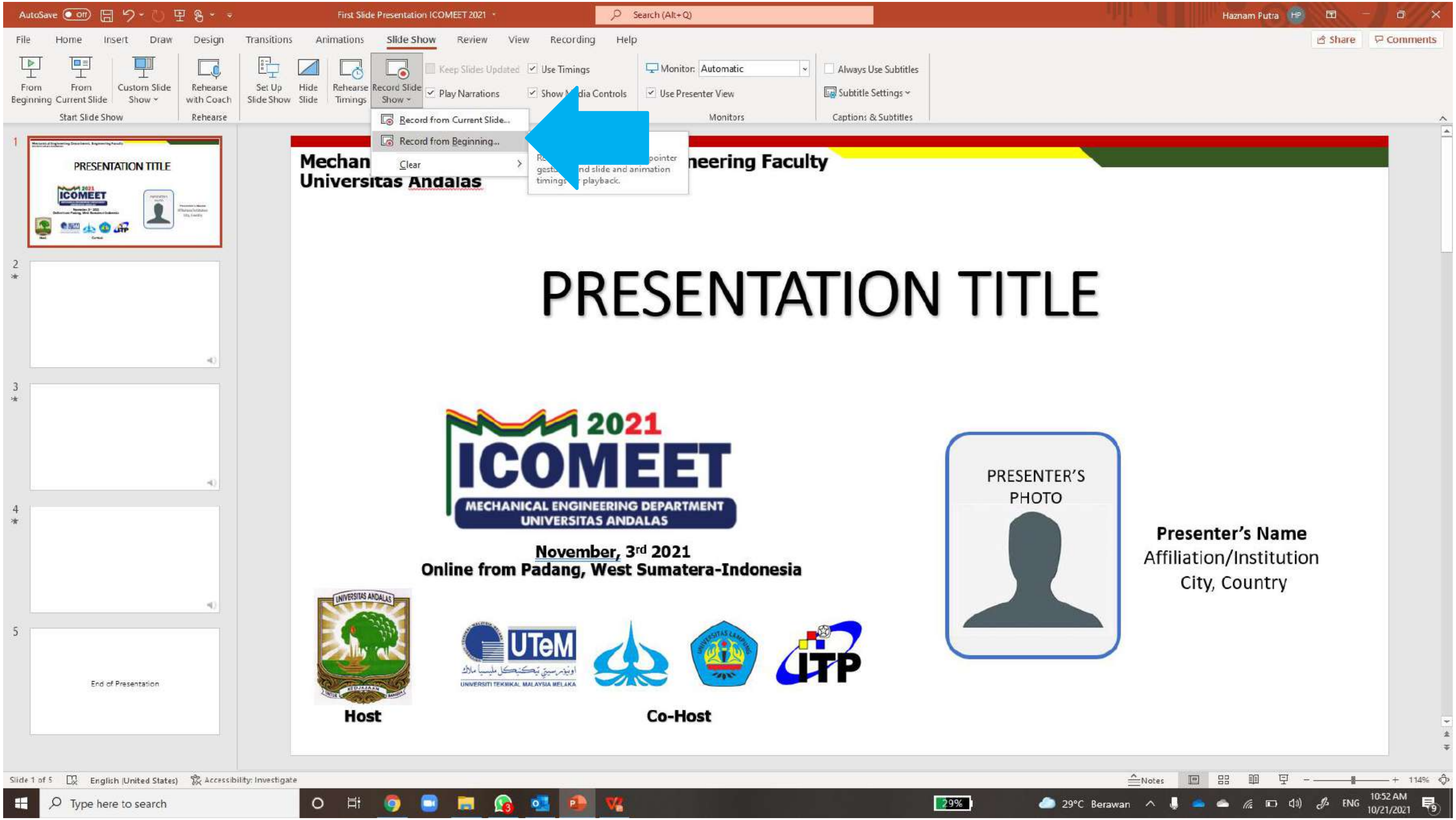
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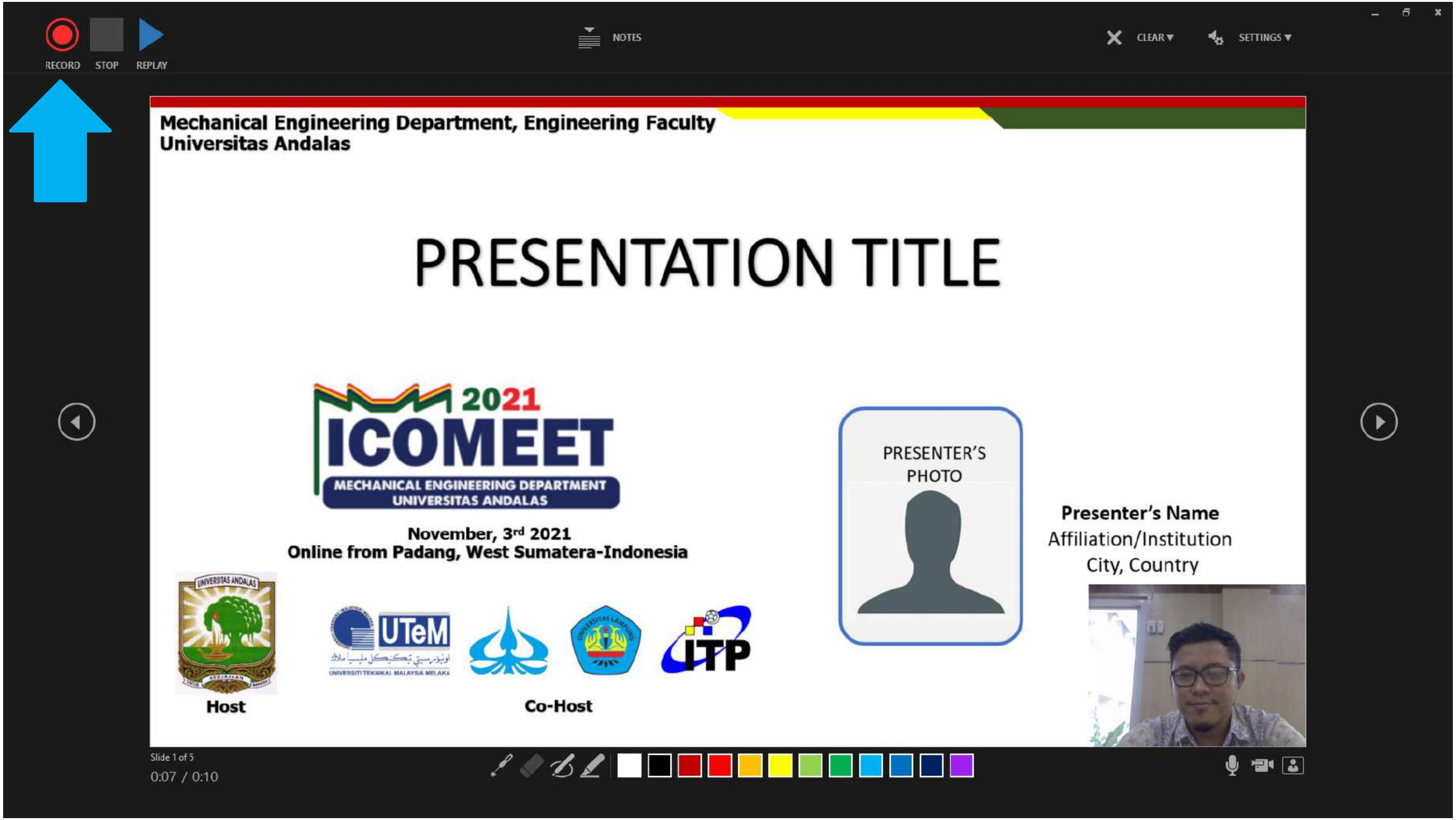
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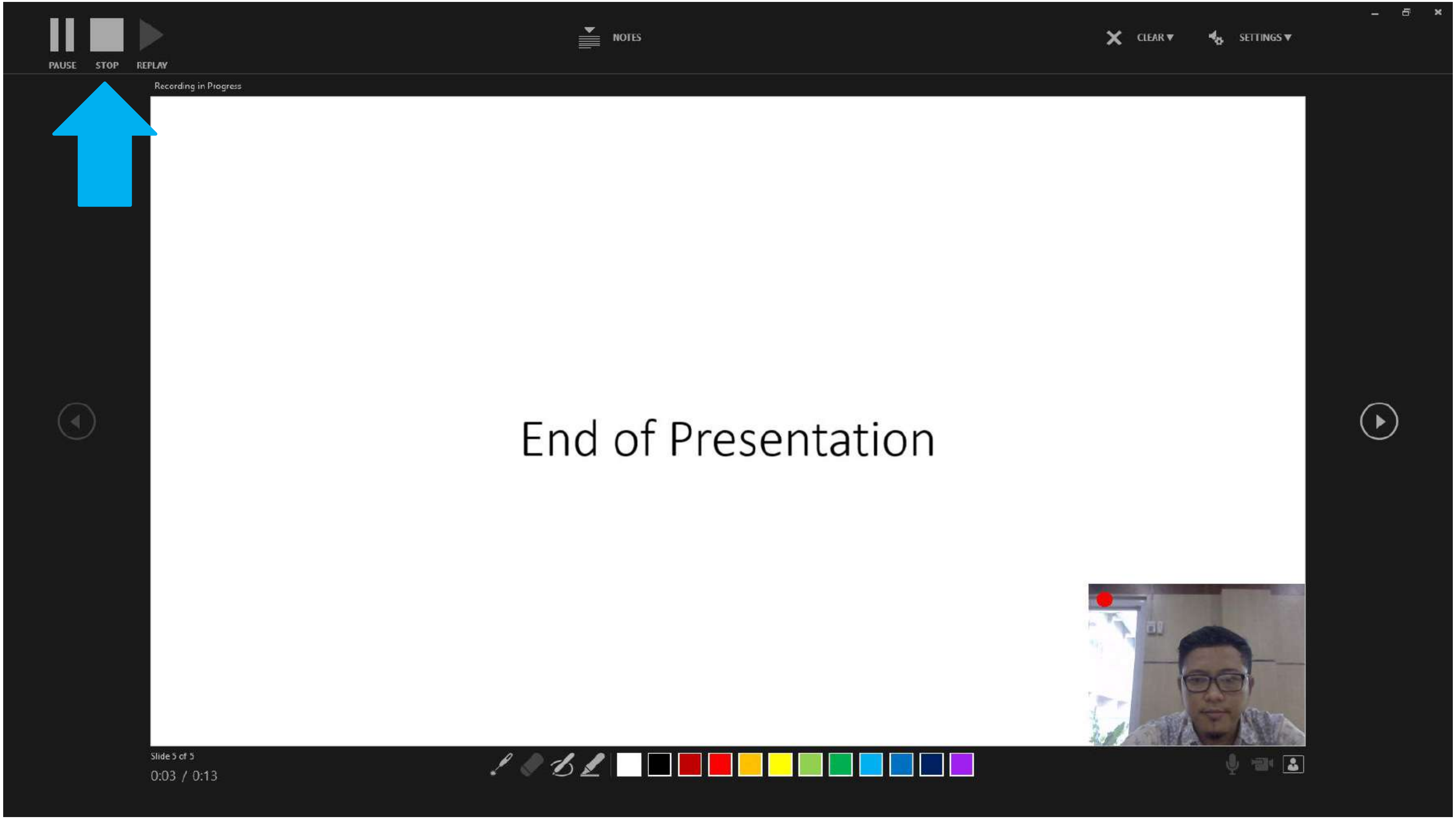
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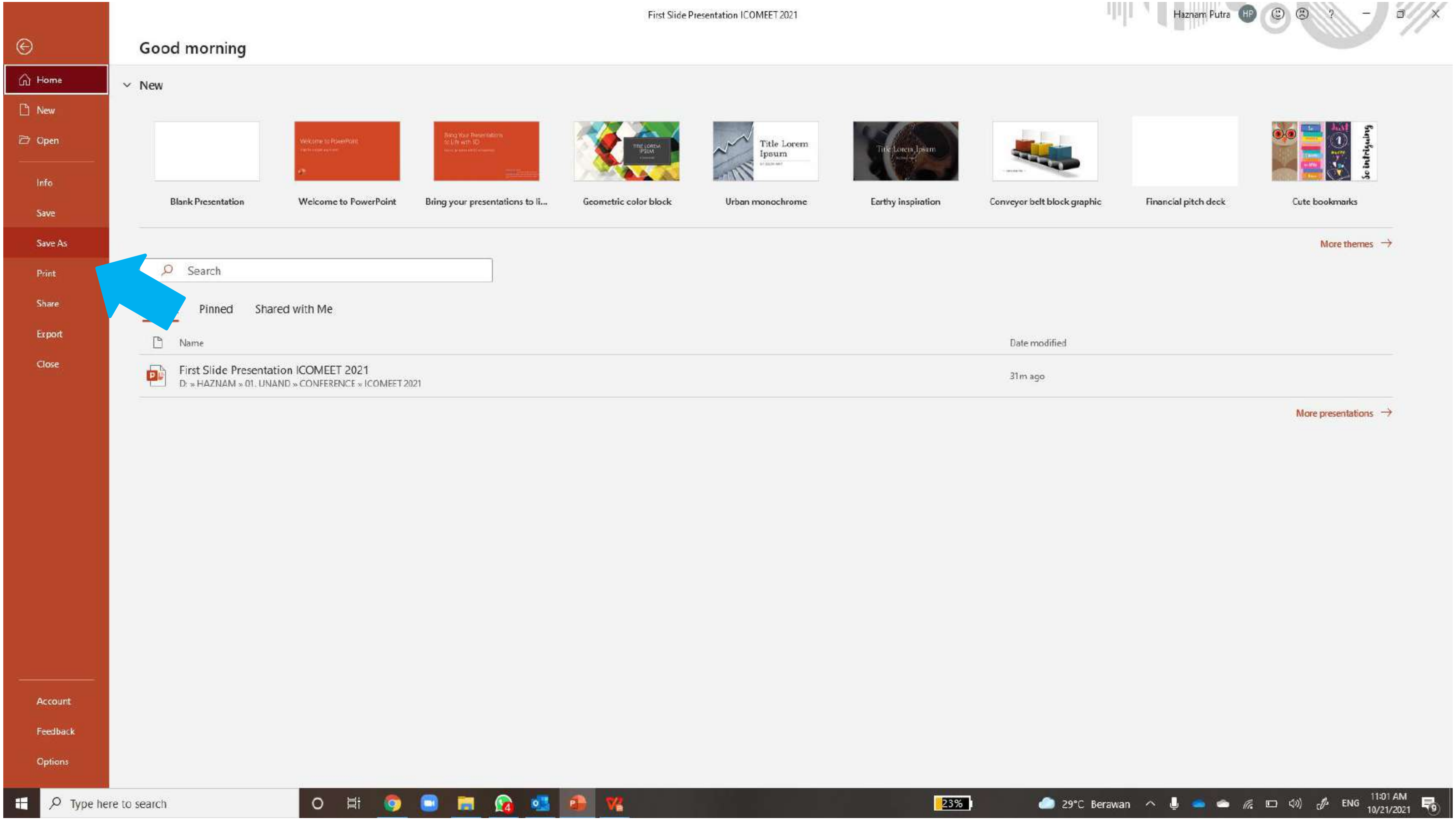
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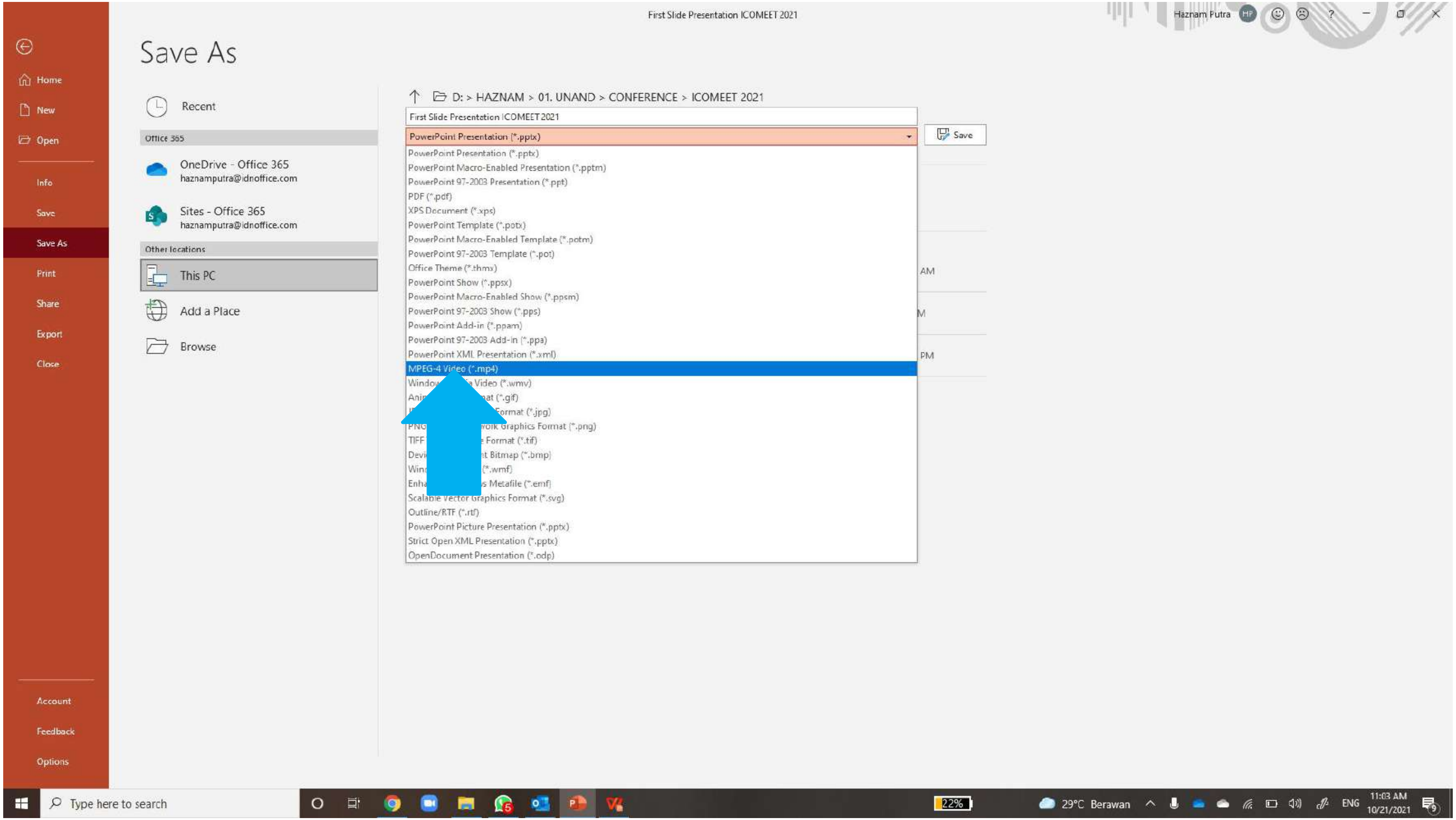
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We have finished reviewing your proceedings material and have found some items that will need to be corrected before we can move forward with production. Please see the attached Excel worksheet detailing our request for replacements.

Please ask authors to review their papers after edits have been made to ensure that they still follow the AIPP guidelines/checklist. Please note that if page sizing and margins were changed and/or tables and figures were corrected, that could affect the body/layout of the paper. We have attached once again for your convenience the AIPCP Guidelines.

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Your manuscript has been successfully submitted to the proceedings of International Conference on Mechanical Engineering for Emerging Technologies (ICOMEET 2021). This message is being sent to you as one of the authors of the following conference proceedings manuscript:

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Best regards,

Lovely Son

Icomeet editor

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On behalf of the ICOMEET 2021 international seminar committee, I would like to ask about the publication status of the ICOMMET seminar at the AIP conference proceedings. According to the information sent by AIP, the publication of the ICOMEET paper will be published at AIP Conference Proceeding on November 19, 2022. Based on this condition, would you inform us whether the publication of the ICOMEET 2021 seminar has been postponed or changed?

Thank you very much for your kindly help and information

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MS#	MS_Type	MS_Title	Decision
AIPCP22-AR-ICOMEET2021-00012	Article	Influence of Quenchant Variations Solution Treatment and Holding Time Artificial Aging on Microstructure and Hardness of Cu-Zn-Al Alloys in Shape Memory Alloy Materials	Pending - Author Submission
AIPCP22-AR-ICOMEET2021-00015	Article	Effect of Current and Electrode Diameter of Gas Metal Arc Welding (GMAW) on Mechanical Properties and Microstructures of JIS G3101 SS400	Pending - Author Submission
AIPCP22-AR-ICOMEET2021-00019	Article	Effect of Spindle Speed, Feedrate, Tool Geometry, and Polyester & Vinylester Blends on Surface Roughness and Surface Hardness Alteration of the Hole	Pending - Author Submission
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Submission Date	27-Jul-2022 02:11:55 **Days Since Original Submission: 0**
Current Stage	Submission Check by Editorial Office Started **Days in Folder: 0**
Title	The Application of Thin Wall Ductile Iron Process in Connecting Rod
Manuscript Type	Article
Article #	036
Conference Name	International Conference on Mechanical Engineering for Emerging Technologies (ICOMEET 2021)
Section	MATERIAL
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The Application of Thin Wall Ductile Iron Process in Connecting Rod

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Abstract. The aim of applying thin wall casting (TWC) technique in ductile iron is to restore the uses of ductile iron in automotive components. TWC will allow ductile iron to compete with lightweight materials, such as aluminium. Nowadays, lighter weight automotive components are needed to reduce fuel consumptions. Applying TWC technique, also known as thin wall ductile iron (TWDI) and thin wall austempered ductile iron (TWADI), in ductile iron also meant guaranteeing that the quality and characterization of the ductile iron are not compromised. This study attempts to investigate the thinnest part of I-beam that can be produced without disturbing the quality and characterization of ductile iron following the outcome of I-beam thickness changing from 4 to 3 mm. The casting design used in this study is the same casting design used in previous study. All the designs were analyzed using Z-Cast simulation software and feasibility for production is examined. All the designs were then casted in a foundry to verify the result of simulation. The cast products were tested in a metallography examination and a tension-compression test which will be discussed comprehensively in other studies. The cast products showed that thin wall ductile iron connecting rod with an I-beam thickness of 2 mm can be produced. Further study for 1mm beam thickness is still needed.
Keywords: TWDI, TWADI, connecting rod, vertical casting, design.

INTRODUCTION

Weight of materials is important parameter since force is a product of weight and velocity. Lighter weight with equal velocity will result in lower force. This leads to an increase in the use of lightweight materials. Aluminium is preferred over steel and cast iron although its fluidity and formability are lower than cast iron and steel as ferrous metals. To overcome this matter and to regain the uses of cast iron, thin wall casting as a new casting technology is presented.

Thin wall casting is a casting technology that is able to produce casting products with wall thickness of less than or equal to 5 mm in parts or all over its parts. This definition was based on Caldera [1]; while Stefanescu took it equal to below 3 mm [2]. Both applied thin wall casting in producing ductile iron plate, known as thin wall ductile iron (TWDI) plate. The thinnest TWDI plate is 1 mm [3].

Martinez et.al [4] applied thin wall casting method in producing hollow connecting rod for two-cylinders prototype engine. In this research Martinez et.al able to reduce its weight for up to 33%. While Sulamet-Ariobimo et.al gain weight reduction to 27% when applying thin wall casting method to the connecting rod of Vespa PX150 as presented in Fig. 1 [5]. The difference between the thin wall connecting rod made by Sulamet-Ariobmo et.al [5] to Martinez et.al [4] is in the design used in the I-rod area.

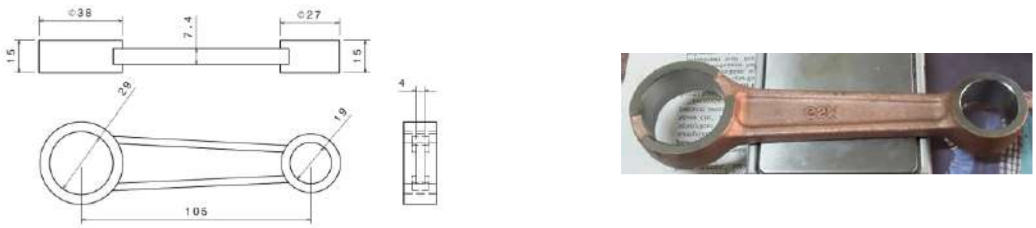


Figure 1. Connecting rod of Vespa PX150

Unlike Martinez et.al [4] who made the hollow connecting rod, Sulamet-Ariobimo et.al applied thin wall casting technique by reducing the thickness of I-beam as presented in Fig. 2. They chose this modification to avoid the difficulty of using the core in mould making process. In the first step, they reduced the I-beam thickness from 4 mm to 3 mm. And based on the result of the previous studies, they reduced the thickness from 3 mm to 1 and 2 mm.

To ensure that TWDI plates and components can be produced by all foundries, even the small scale one, Sulamet-Ariobimo et.al chose not to interfere with the processes running in the foundry and made casting designs to produce thin walls. They began their projects with making casting designs to produce TWDI and TWADI plates [6], [7] [8]. Through these projects they were able to determine the key parameters regarding TWDI design. Based on that finding, they built designs for TWDI and TWADI components [5], [9], [10].

The aim of this studies is to discover the lowest possible wall thickness to be applied to the I-rod in order to reduce weight of the connecting rod without decreasing the quality of ductile iron and still fulfilling design requirements.

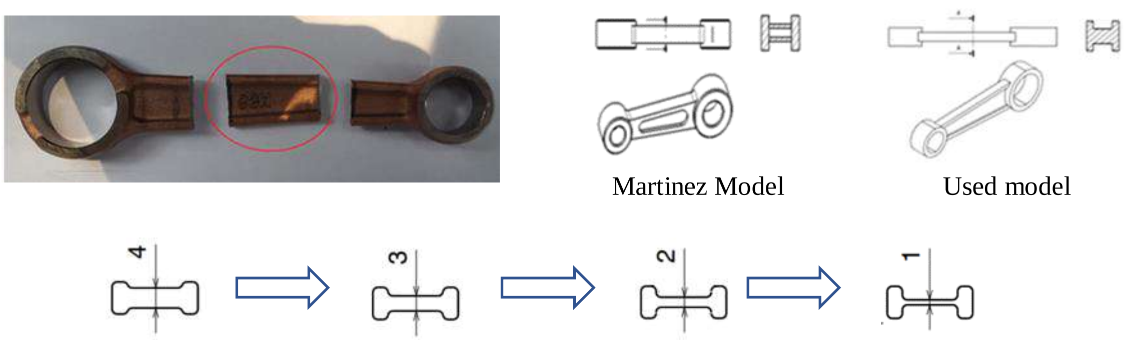


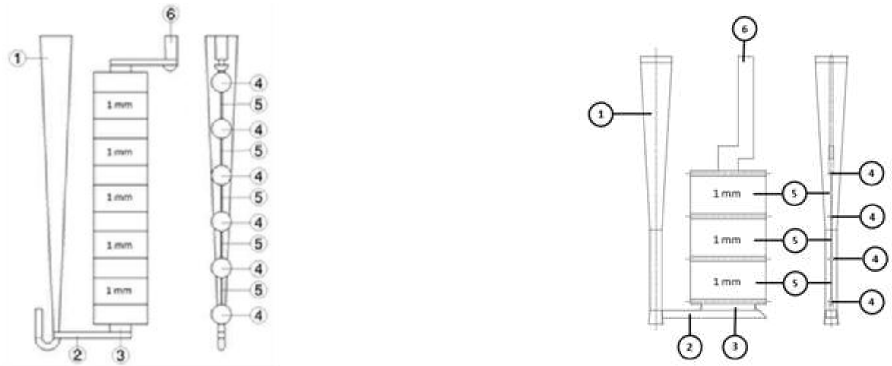
Figure 2. Modified Area and Modification

EXPERIMENTAL METHODS

Casting design was built based on patented casting design number IDP000070457 deigned to produce three plates of TWDI with 1 mm thickness with the matrix of pearlite as presented in Fig. 3.a [8]. This design was the modification of casting design with the patent number IDP000039503[6] as presented by Fig. 3.b. The purposed casting design can be seen in Fig. 4. This design was made to produce connecting rod with I-beam thickness of 3 mm [5]. This design was then developed to produce connecting rods with the I-beam thickness of 2 and 1 mm.

The casting designs were then analyzed using Z-Cast simulation for filling, solidification and defects. Z-Cast is a casting simulation made by KITECH – South Korea. Z-Cast estimates the mould filling process and metal solidification. The boundary conditions of Z-Cast are cast material, mould material, pouring time, pouring temperature and heat transfer coefficient. Color scheme in filling process reveals the condition of temperatures in molten metal. The temperature unit is degree Celsius (^{O}C) and degrade from white to blue in color. In the solidification process, color indicates temperature as well as the filling process. The blue color in this process indicates phases changing from molten to solid metal. Lighter blue color is associated with lower temperature and tendency of solidification process completion. Blue and red color schemes in shrinkage mode indicate shrinkage. Red indicates shrinkage in products, while blue indicates shrinkage in the gating system. These results indicate a need for scrutiny because in certain designs, the simulation cannot clearly recognize the function of each part.

The previous design was directly applied to the design of connecting rod with I-beam thickness of 2- and 1-mm. Modification is only applied in the thickness of the I-beam. The designs were simulated in Z-Cast. Following the result of Z-Cast analysis, the casting designs were then improved. The improvement was made based on the shrinkage simulation results. Coding of the design is presented in Table 1. The coding is divided into three groups. The first one is for the basic design produced by the previous study. The code used is also the code used in previous study. The second group is for the direct application of casting designs, and the third one is for the improved designs.



a. Patented No. IDP000039503 b. Patented No. IDP000070457

Figure 3. Casting Design.

1. down sprue 2. runner 3. ingate 4. riser 5. plate 6. gas tunnel

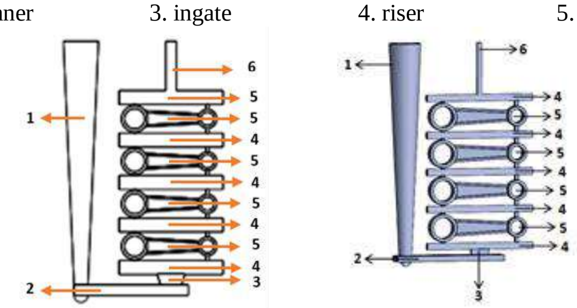


Figure 4. Casting Design

1. down sprue 2. runner 3. ingate 4. riser 5. connecting rod. 6. gas tunnel

Table 1. Coding of the Design

Code	Description
D – S4M [5]	Basic design for 3 mm I-beam thickness
D – 2mm	Modified design for 2 mm I-beam thickness
D – 1mm	Modified design for 1 mm I-beam thickness
DM1 – 1mm	Modified design in ingate for 1 mm I-beam thickness – enlargement of ingate dimension
DM2 – 1mm	Modified design in ingate for 1 mm I-beam thickness – removing ingate

The improved designs were produced in foundry scale to verify the simulation results and casting yield were calculated to find out the weight reduction. Chemical composition uses in casting process can be seen in Table 2. Metallography examination and compression test were conducted to guarantee the quality of TWDI materials.

RESULT AND DISCUSSION

In their previous study, Sulamet-Ariobimo et.al were able to produce thin wall connecting rod with I-beam thickness of 3 mm. This I-beam can improve casting yield to up to 41% and reduce weight to up to 3.5% from normal connecting rod with I-beam thickness of 4 mm using FCD450 and 13.4% from original component using SCM420 [5]. This study then continues by using the casting design to produces lighter connecting walls by reducing I-beam wall thickness to 2 and 1 mm.

The comparison of the filling process is presented by Fig. 5. The filling process in D-S4M [5] appears slower when compared to D-2mm and D-1mm. Upon verification with the simulation data, D-S4M needed 1.5 second to reach 30% volume, while D-2mm and D-1mm were able to reach 45% volume in 0.8 and 0.769 second, respectively. The temperature colors inside the cavities are a mixture between yellow and orange, with yellow dominant. D-1mm has more orange color compared to the others. During the filling process, temperature drop (showed by blue color) happens in D-1mm within the first connecting rod. This may be associated with premature solidification. All fillings managed to reach 100% volume and blue color appears in all designs with varying percentages. The highest occurs in D-S4M and the lowest occurs in D-2mm. This is also an indicator that filling process in D-S4M requires more time than D-2mm and D-1mm. This also confirms that premature solidification will not occur as long as there are still molten metals running through the system. In the solidification process, blue color is seen in the I-beam and dominates D-1mm and D-S4M. Blue color indicates the source of solidification. I-beam is the thinnest part in the component; therefore, the initiation of solidification is appropriate. While at 100% solidification, the final zone to have completed the solidification process is the freeze zone located in the riser connected to the ingate. This also supports the casting designs. Data gained from the simulation reports show that D-S4M has the fastest solidification rate at 340 seconds to reach 100% volume, while D-1mm has the lowest, at 388 seconds. But based on the blue color gradation, although D-2mm has faster solidification time, D-1mm has lighter blue color. While in D-1mm, blue shrinkage is found in the area of ingate. It is also seen that the highest amount of shrinkage can be found in D-S4M, follow by D-2mm. D-1mm has the smallest one. These results should be noted, because ingate shrinkage may possibly cause issues in the finished product.

Table 2. Chemical Composition of Liquid Metals

Chemical Composition		**Standard ASM Handbook**	**Modified Connecting Rod – I-beam Area**		
			3 mm [5]	**2 and 1 -mm**	
% Weight				**Batch – 1**	**Batch – 2**
Carbon	C	3.600 – 3.830	3.620	3.670	3.810
Silicon	Si	1.800 – 2.800	2.540	2.680	2.650
Manganese	Mn	0.150 – 1.000	0.420	0.440	0.400
Copper	Cu	0.015 – 1.000	0.230	0.270	0.190
Chromium	Cr	0.030 – 0.070	0.090	0.003	0.050
Nickel	Ni	0.050 – 2.000	0.007	0.001	0.010
Manganese	Mg	0.030 – 0.060	0.040	0.005	0.040
Phosphor	P	< 0.3000	0.020	0.001	0.010
Sulphur	S	< 0.020	0.020	0.002	0.010
Molybdenum	Mo	0.01 – 0.100	0,00	0.010	0.010
Carbon Equivalent	CE	4.59	4.47	4.37	4.70

Based on this finding, modifications are made to D-1mm since the shrinkage profile, although its color is blue, suspected occurs on products. The modifications are made as presented by Fig. 6 and Fig, 7. Modification in Fig. 6 shows enlargement in both ingate from 5 mm to 7.5 mm. While modification in Fig. 7 removes the ingate, allowing the product to act as the ingate.

The filling results for improved design as presented by Fig. 5 show that filling process in DM2-1mm is faster than DM1-1mm. In 0.514 second, DM2-1mm is able to fill 30.025% of the volume; while DM1-1mm is only able to fill 30.0018%. This is in line with the modification applied to DM2-1mm, which removes the ingate and allows the product to serve as the ingate. The same conditions will also occur when comparing the filling speed of DM2-1mm to previous designs. DM2-1mm reaches its 100% filling in 1.703 second. Both DM1-1mm and D-1mm need 1.704 seconds to reach the 100%. A drop in temperature happens in both improved designs, with DM1-1mm having highest percentage. Both designs are able to reach its 100% filling volume and during the final filling. DM2-1mm has no trace of blue color. When compared to all designs D-S4M still has the highest percentages of blue color and DM2-1mm has no trace of it. Blue color is seen in the I-beam in the beginning of solidification process and dominating in all designs except D-2mm. In D-2mm there is also blue color but the blue color is not dominating as much as in the other design. It just located in the middle of I-beam. As is the case with previous designs, the direction of solidification and last to freeze zone are in compliance. D-S4M still has the fastest solidification rate at 340 seconds to reach 100% volume, while DM1-1mm has the lowest at 390 seconds. Shrinkage result of DM1-1mm shows that the improved design is able to move the shrinkage to riser and ingate. Meanwhile DM2-1mm obtains opposing results: shrinkage take place within the big rod. This finding shows that eliminating ingate is not a right choice.

Based on the analysis of simulation result, D-2mm and DM1-1mm are cast. The result of the casting process is presented in Fig. 8. There are two results for 2- and 1-mm I-beam thickness since there are challenges during the pouring process which caused product failure. The failure is attributed to the discontinuity during the pouring process and mold leakage, therefore not design-related. In the second pouring, connecting rod with 2 mm thickness of I-beam was successfully produced, but vice versa for the 1 mm thickness of I-beam. Further analysis is needed to resolve this issue.

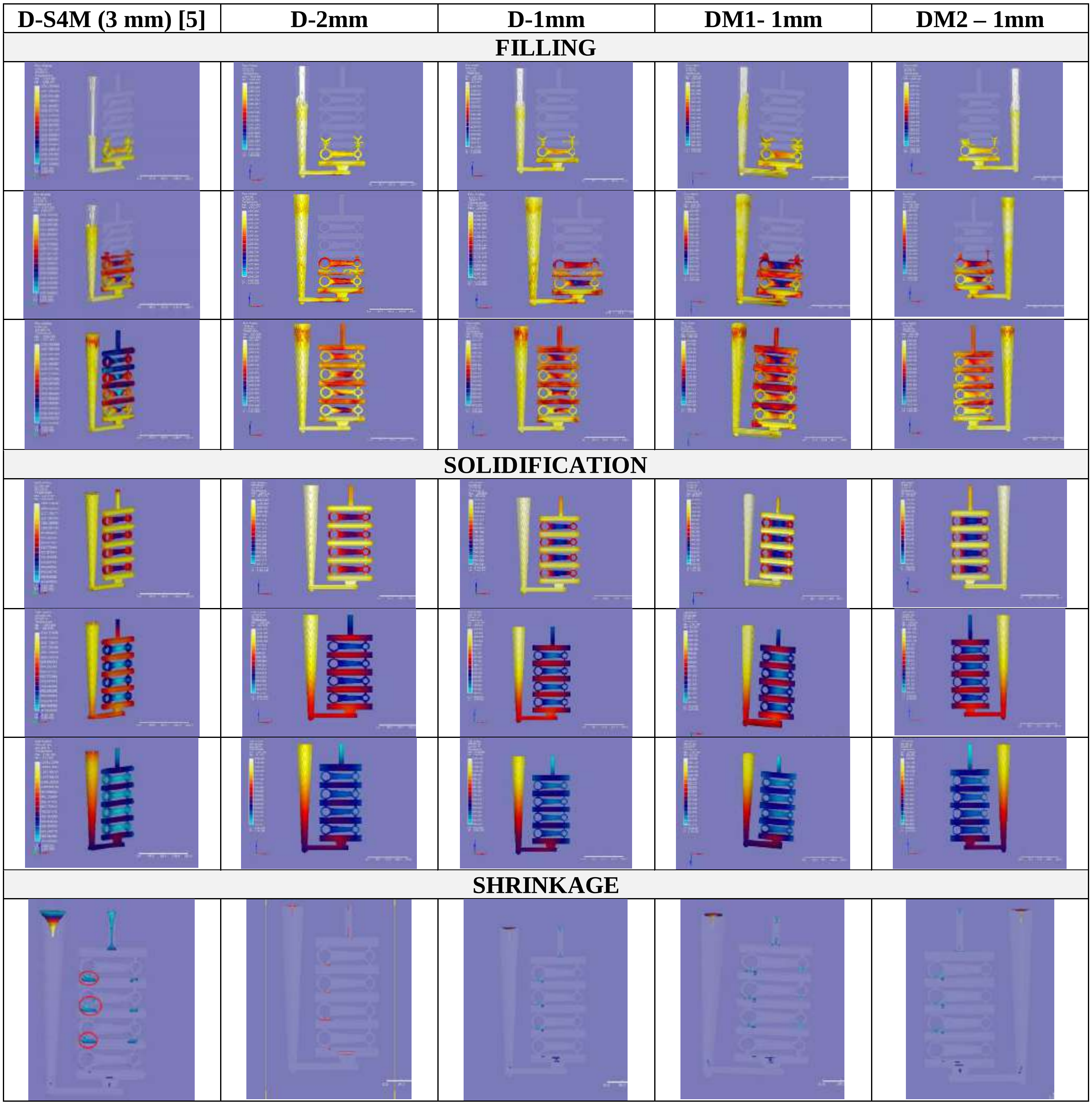
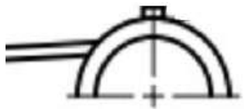


Figure 5. Simulation Results for All Designs

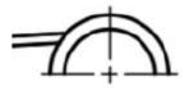
a. Design of D-S4M

b. Improved Design for DM1-1mm

Figure 6. Modification of Ingate for D-1mm



a. Design of D-S4M



b. Improved Design for DM2-1mm

Figure 7. Modification of Ingate for D-1mm

a. I-beam Thickness 3 mm

b. I-beam Thickness 2 mm

c. I-beam Thickness 1 mm

Figure 8. Casting Products

I-beam thickness	Rod-end		I-beam	
	Un – etched	Etched	Un – etched	Etched
3 mm				
2 mm				

Figure 9. Metallography Examination

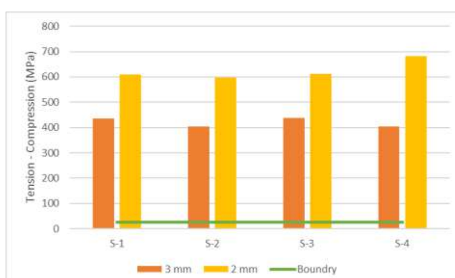


Figure 10. Compression Strength

The result of Metallography examination for both 3- and 2-mm thickness is presented in Fig. 9. The microstructure of both types is nodule graphite in pearlitic matrix. The un-etched microstructure of 3 mm I-beam thickness shows the existence of primary graphite. The graphite tends to be smaller in I-beam. Compression–tension test was chosen as the method for mechanical testing due to the load that will be borne by the connecting rod. The result is presented in Fig. 10. The green line is the load that the connecting rod must accommodate. The instrinsic compressive strength of TWDI surpasses its strenght requirements.

CONCLUSIONS

The conclusions of this study are:

1. The thinnest part applied in connecting rod without degrading its quality is 2 mm I-beam thickness.
2. Casting design of the 3 mm I-beam thickness can be applied directly to make 2 mm.
3. Metallography examination reveals that the microstructure of TWDI connecting rod is nodule graphite in the pearlitic matrix and the compression strength of TWDI connecting rod was able to fulfil the requirement needed by connecting rod.
4. In making a cast product, casting design is just one of many parameters that will support the casting soundness products.
5. Premature solidification will not occur as long as there are still molten metals running through the gating system.
6. In modifying casting design, care should be taken to ensure that the right design decisions are made. The use of casting simulations are recommended.
7. In casting process, smaller or thinner dimension is not directly associated with rapid cooling rate.

ACKNOWLEDGMENTS

The authors wish to express their gratitude to Faculty of Industrial Technology Universitas Trisakti for the research funding. Department of Metallurgy and Material Engineering Faculty Universitas Indonesia and KITECH – Korea for Z-Cast Simulation Software. Last but not least, PT. Geteka Founindo for producing the connecting rod prototype.

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Manuscript ID #: AIPCP22-AR-ICOMEET2021-00036
Article Title: The Application of Thin Wall Ductile Iron Process in Connecting Rod
Name: Rianti Sulamet-Ariobimo
Author(s): Rianti Sulamet-Ariobimo, Siti Aziza, Fadhlan, Yoska Oktaviano, and Yusep Mujalis
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