

A Novel Fiber-Reinforced Composites Manufacturing System Development: Multi-Drop Filling Process

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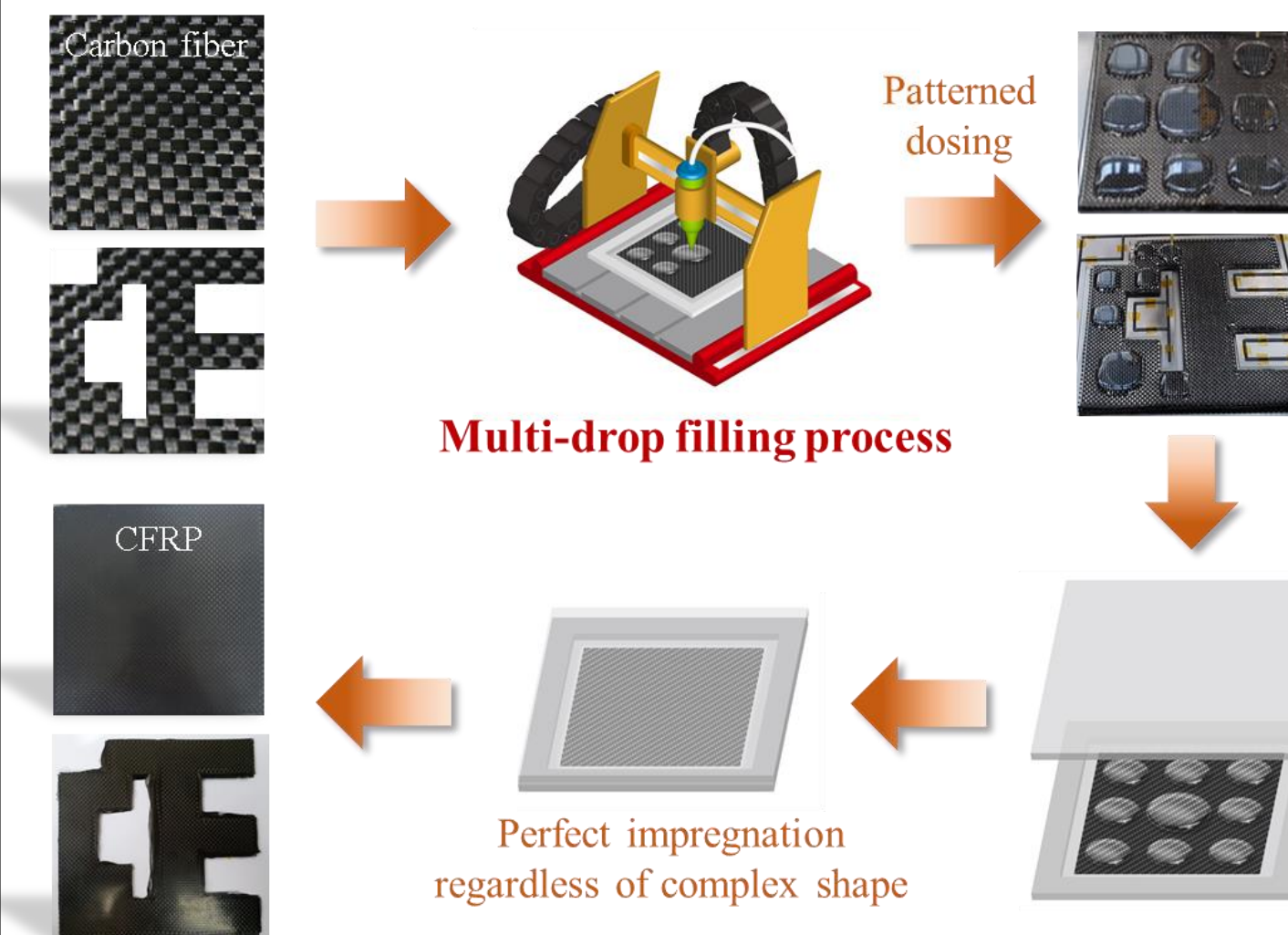
1. Introduction

❖ Liquid composite molding



- Possible to fabricate large products, semi-automated processes.
- Need to overcome **impregnation ability** in **complex-shape** product fabrication.
- Should **simplify equipment** and **drop its prices**.

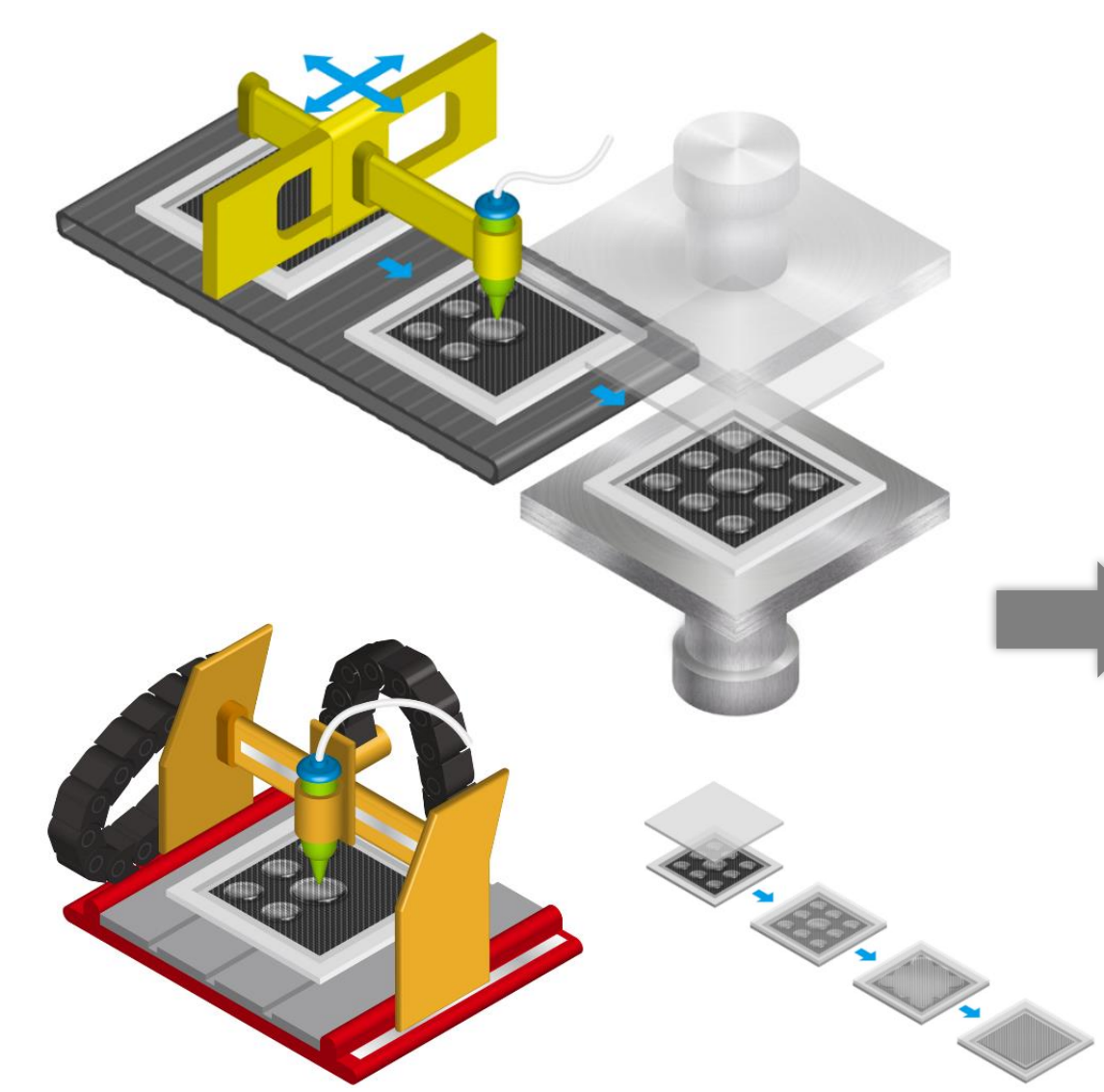
❖ Aim of the research



- Establishing the Multi-Drop Filling (MDF) process.
- Verifying the process **stability** and **feasibility**.
- Achieving **High productivity**, **Upgraded impregnation ability**, and **Free design compatibility**.

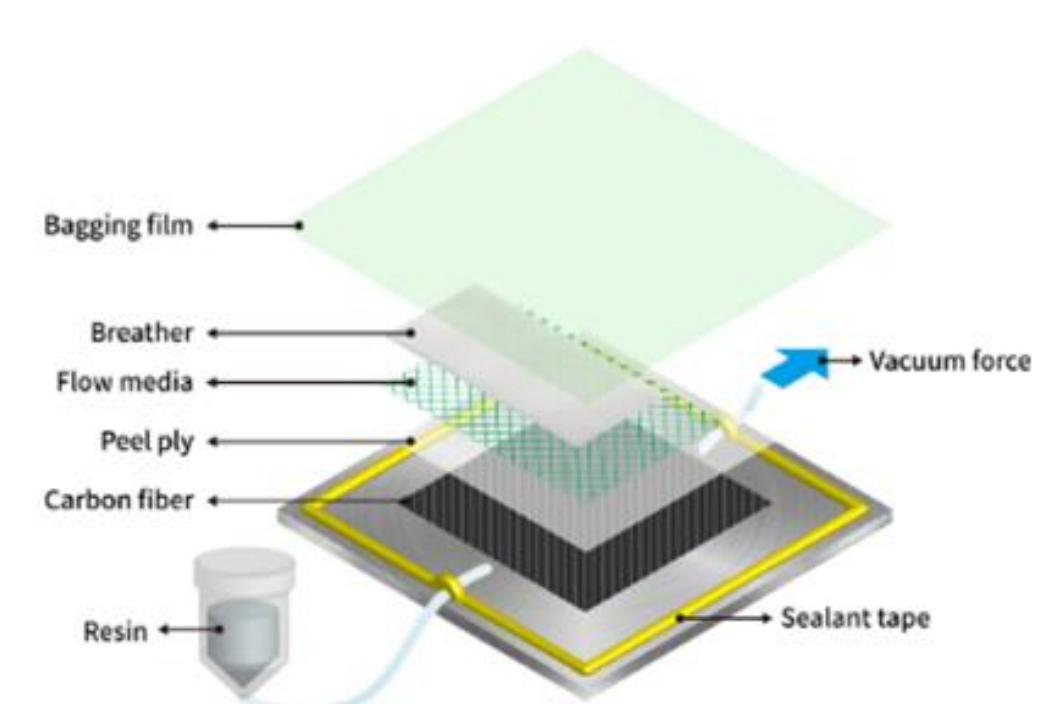
2. Experiment

❖ Novel process



- Resin dosing location selective program.
- Fast resin impregnation with good quality.
- Easy complex-shape molding.

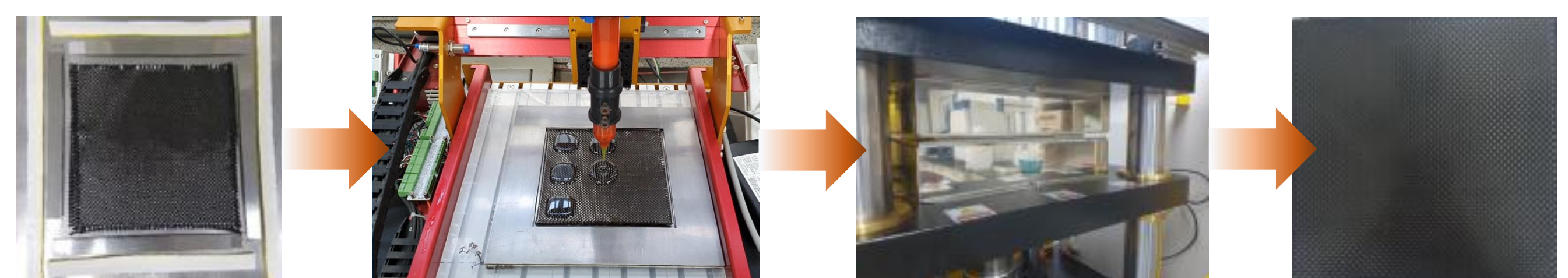
❖ Conventional process



- Representative CFRP manufacturing process.
- Resin flow-dependent process.
- Plate and complex shape molding were both progressed.
- Pre-processed for risky zone observation.

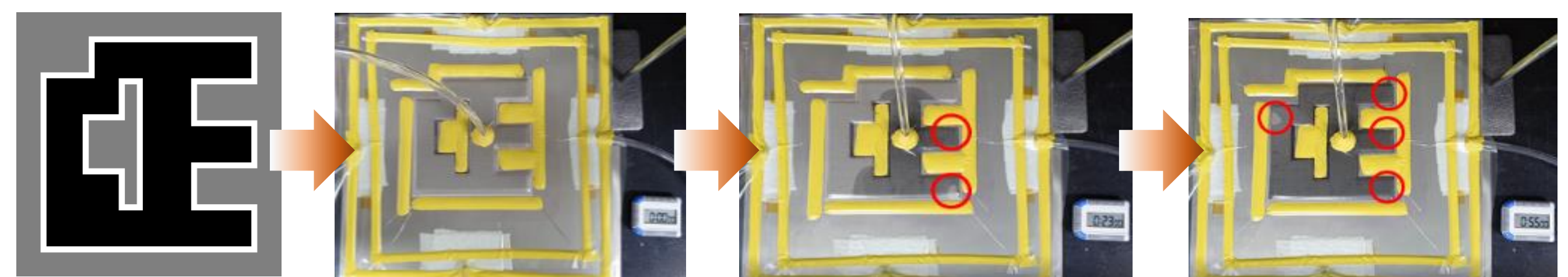
❖ Sample fabrication

➤ Plate shape fabrication

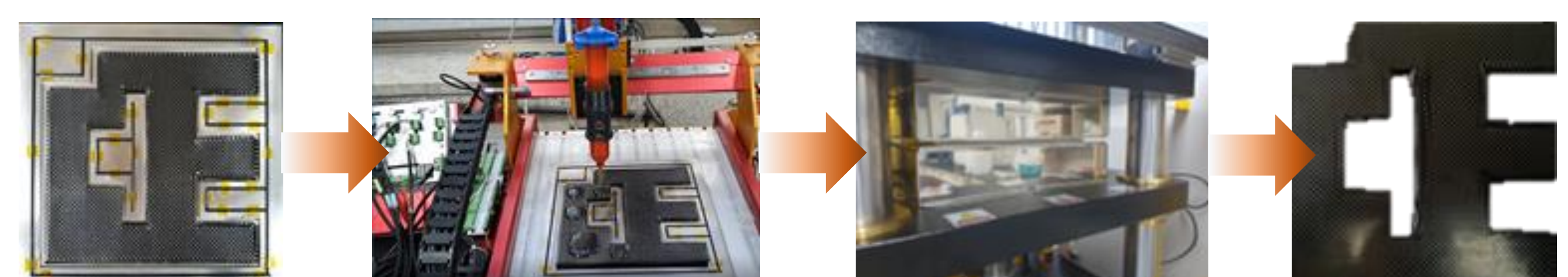


MDF → Plate shape CFRP fabrication step

➤ Complex-shape fabrication



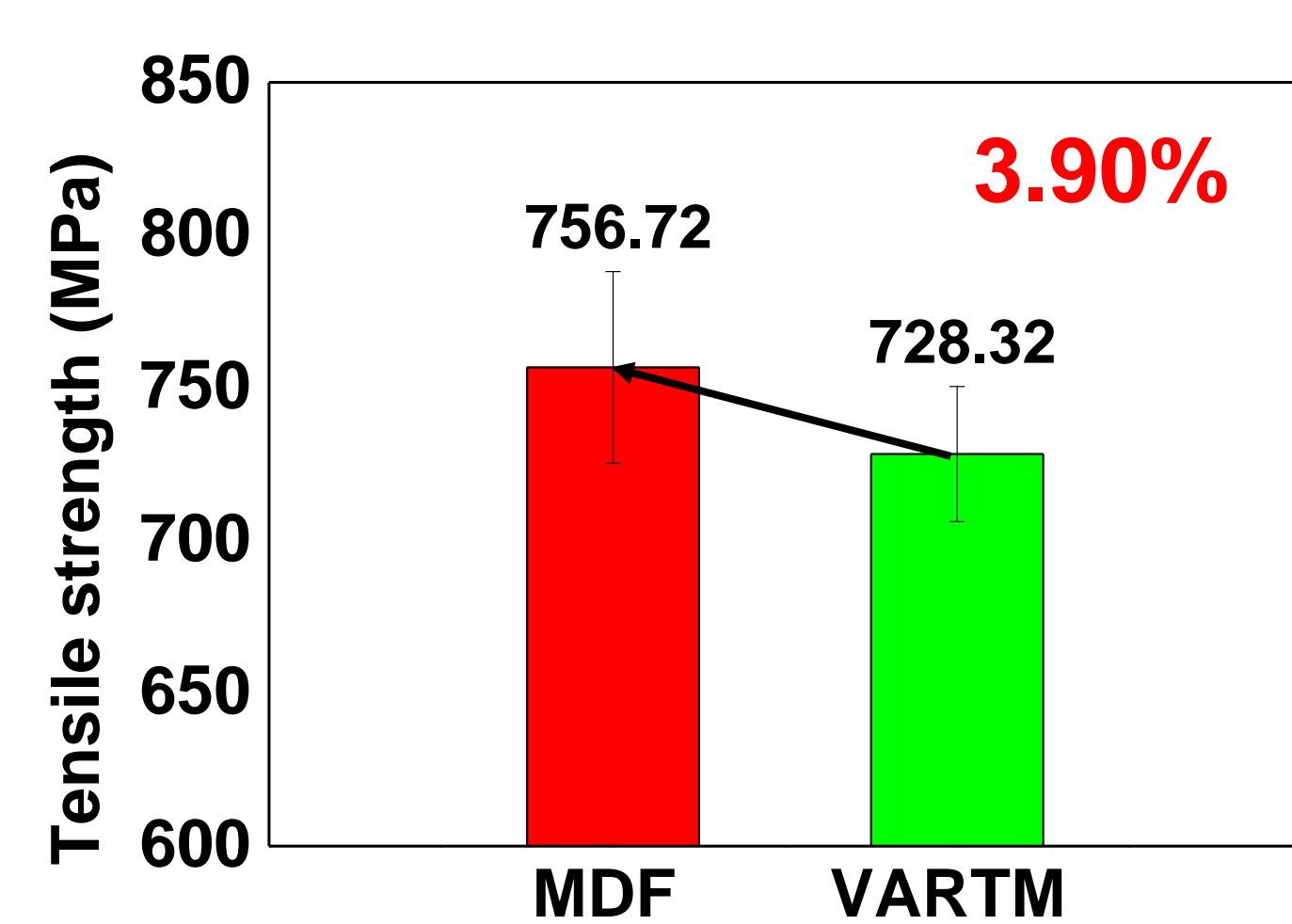
VARTM → Risky zone observed



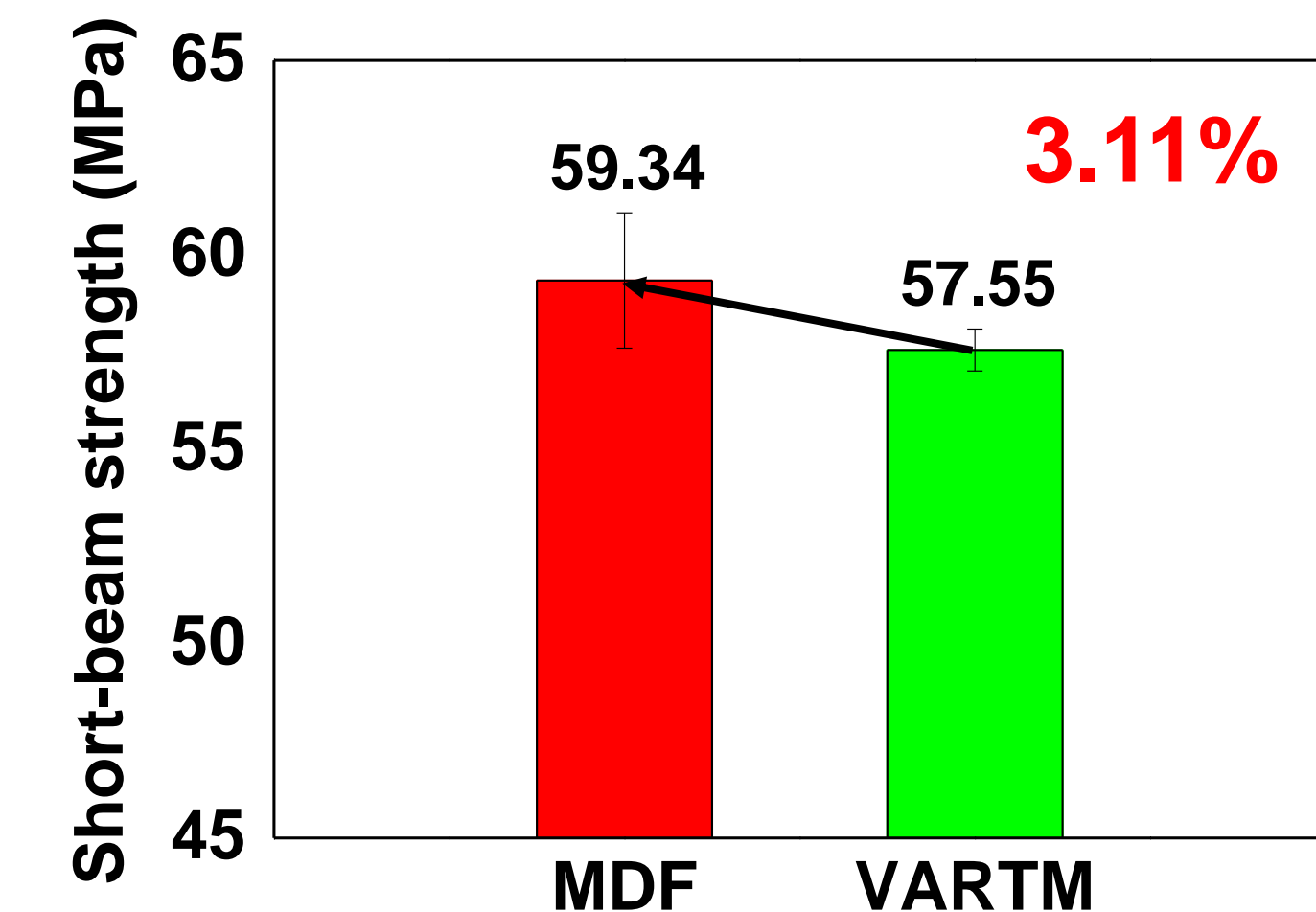
MDF → Complex-shape CFRP fabrication step

3. Results & discussion

❖ Stability and feasibility verification

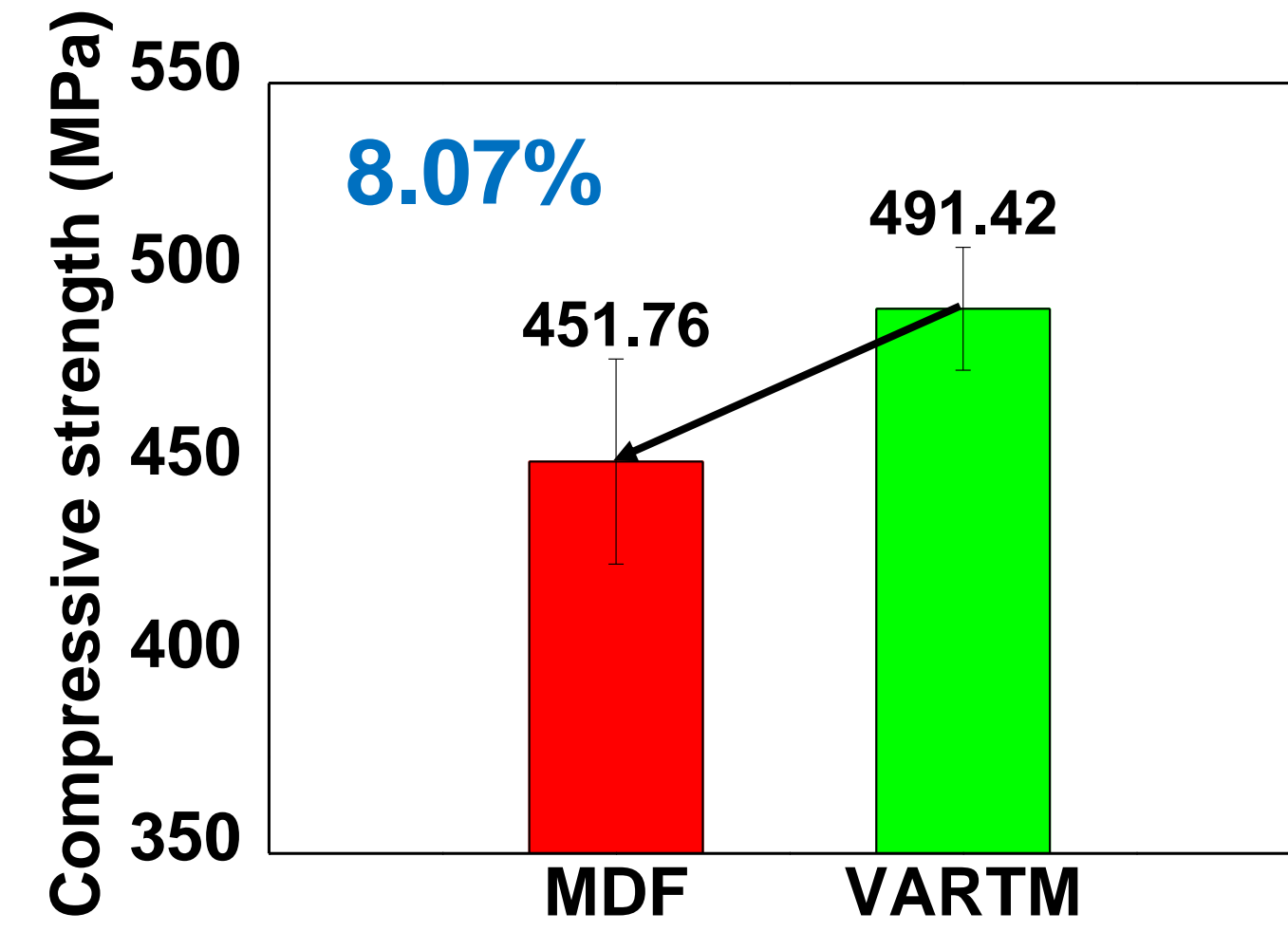


3.90%

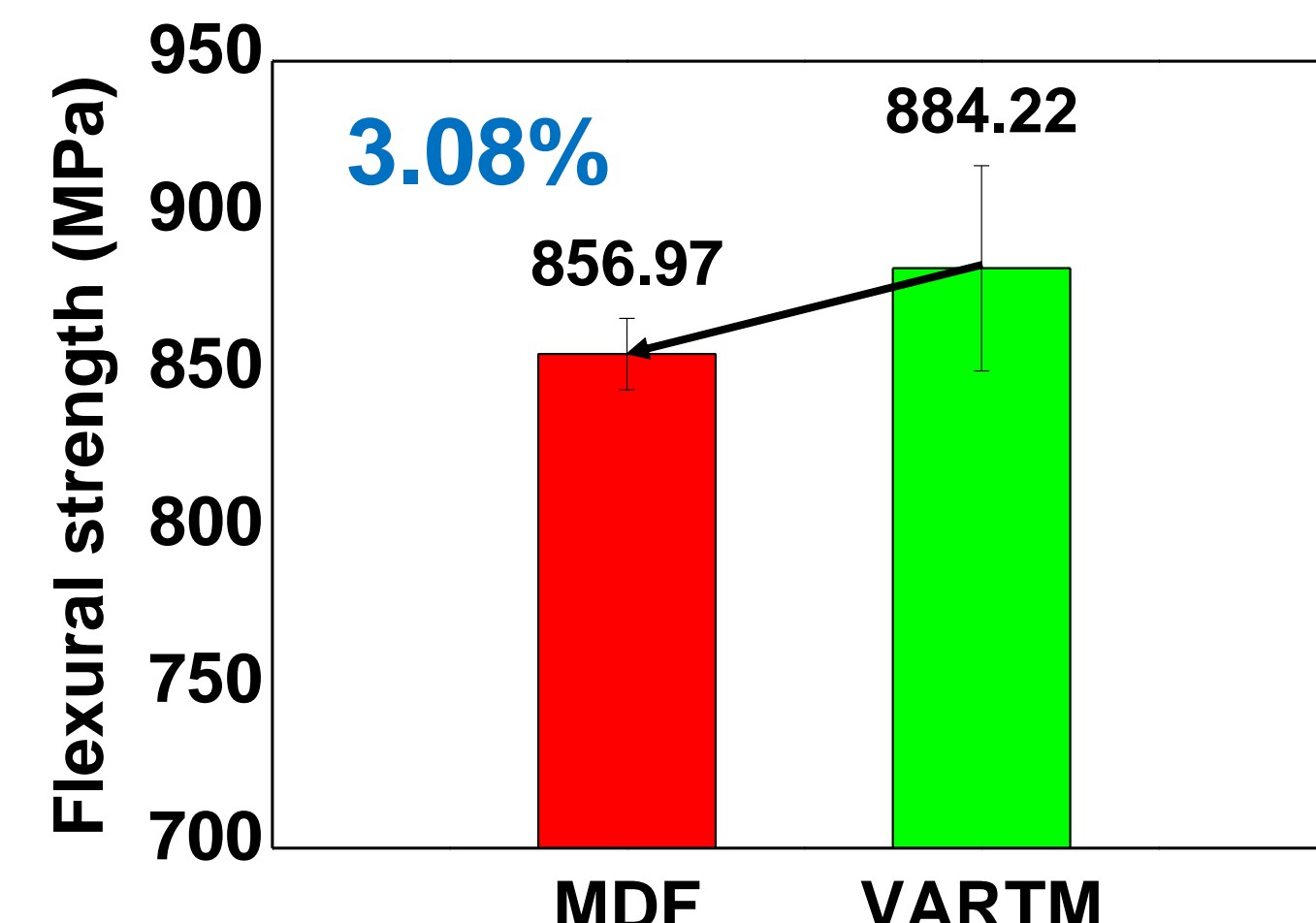


3.11%

Increased tensile & short-beam strength



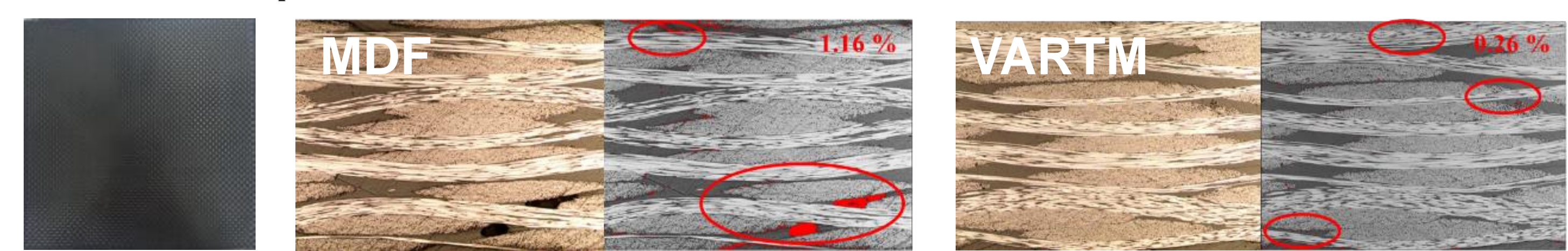
8.07%



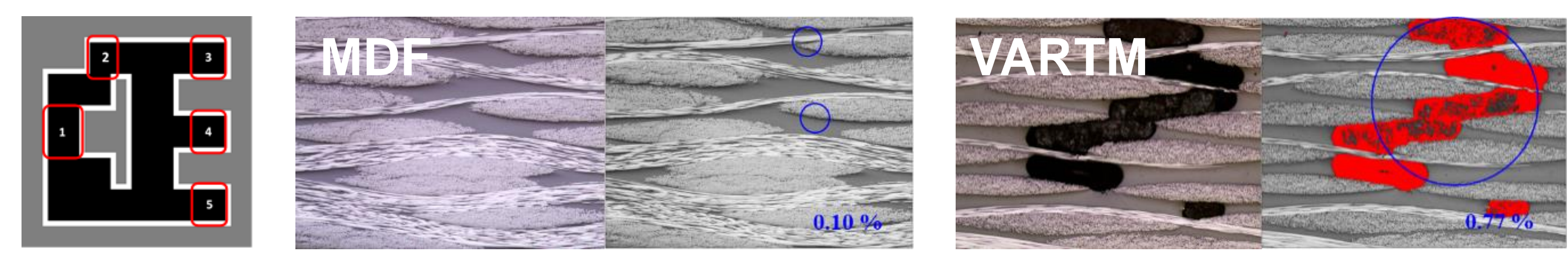
3.08%

Decreased compressive & flexural strength

Plate shape void content



Complex-shaped void content



Comparative analysis (MDF vs Conventional process)

1. Mechanical property (in plate shape CFRP)
Maintaining similar mechanical properties → **Stability & Feasibility**
2. Void content (in plate & complex-shape CFRP)
Additional resin drops to the observed risky zones
→ Reduce void contents → **Improving impregnation ability**

Kang SI, Yoo JJ, Kim MG, Seong DG. A new variant of liquid composite molding process based on multi-drop resin filling. Materials Today Communications 2022 June 2022; 31: 103363.

4. Conclusion

- The novel liquid composite molding process called **Multi-drop filling (MDF)** has been successfully established and optimized.
- Comparing the **mechanical properties** and the **void contents** of fabricated CFRP samples, **the MDF** verified its **stability** and **feasibility** as an FRP manufacturing process
- Fabricating complex-shaped CFRPs, the MDF showed better complex-shape molding ability: **High productivity**, **Upgraded impregnation ability**, and **Free design compatibility**.

❖ Acknowledgment

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