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MSEC 2025 | NAMRC 53

June 23-27, 2025, Greenville, South Carolina

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THE IMPACT OF SUBSTRATE COLOR ON FEATURE RESOLUTION IN 3D INKJET PRINTING

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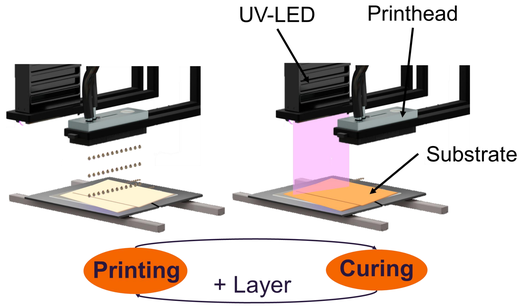
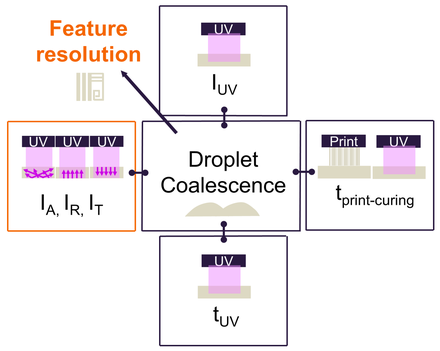
INTRODUCTION

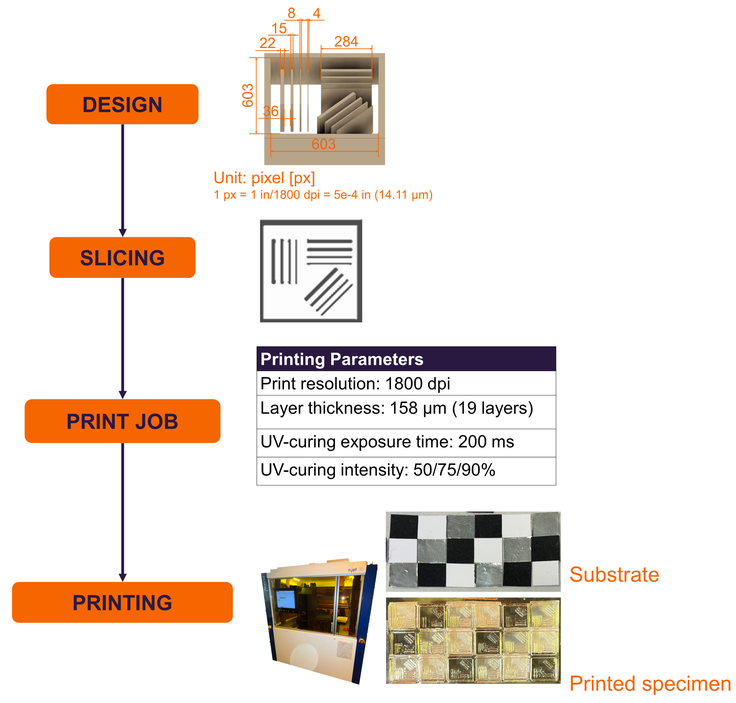




ABSTRACT

3D inkjet printing is an additive manufacturing technology that generates 3D objects layer by layer by printing thousands of droplets. The process involves multiple sub-processes, such as printing and curing which requires a close process control in order to achieve high accuracy. Specifically, the **curing** of the printed layer has been shown to influence **feature resolution**, as curing settings determine the coalescence behavior between adjacent droplets. The **objective** of this study is to investigate whether the **color of the substrate** significantly affects feature resolution. A transparent UV-sensitive ink is used to print a 3D object consisting of multiple thin walls with 3 different UV intensities (50%, 75% and 90%) on a substrate with 3 different colors (**black, white and metallic**). This study confirms that the substrate color has a considerably effect on the feature resolution as the UV-radiation transmit through the transparent layer. In the case of white and metallic color, the reflected UV-radiation cures the printed layer additionally and improves the feature resolution.

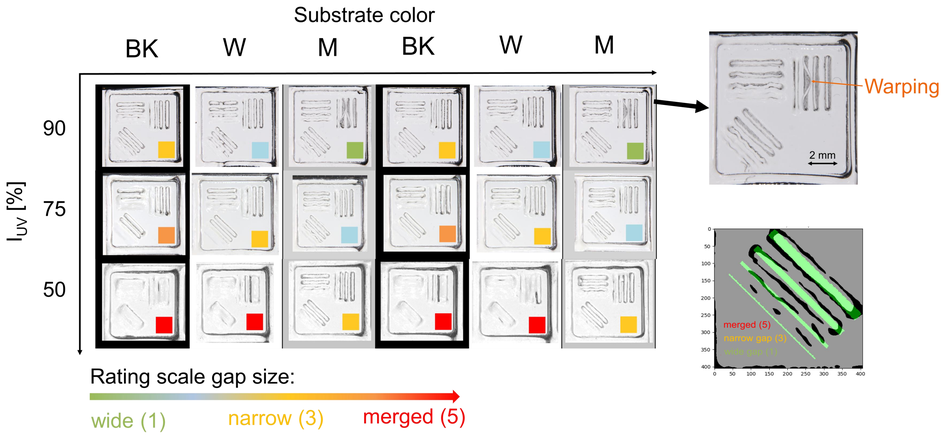
METHODS

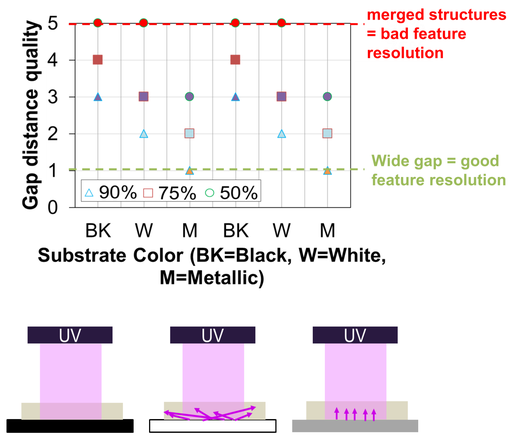


RESULTS & DISCUSSION

Criteria for the quality of the feature resolution is the **gap distances** between the structures. A wider gap size indicates improvement of the feature resolution.

Gap between elements changes in dependence of substrate color and UV-intensity. The droplets spreads less when the substrate color is changed from black to white to metallic surface. This behavior is evident for all UV-intensities.





CONCLUSION

- The impact of different substrate color on the resulting feature resolution is evident for a 3D object printed from a transparent ink and with a layer thickness of ~150 µm.
- Adjusting substrate color or color of the ink can improve the achievable accuracy of the printed feature without increasing the UV-source settings.
- The improvement utilizes the reflective property of the substrate which facilitates additional curing of the printed layer from the bottom.
- Higher degree of curing decelerates the droplet spreading, and smaller droplets and higher accuracy can be achieved.
- In multi-material printing, different UV-light interaction behavior might require a complex control of the curing condition to ensure consistent curing result.

ACKNOWLEDGEMENT

This work was carried out with the support of the Karlsruhe Nano Micro Facility (KNMFi, www.knmf.kit.edu) a Helmholtz Research Infrastructure at Karlsruhe Institute of Technology (KIT, www.kit.edu) and under the Helmholtz Research Programme MSE (Materials Systems Engineering) at KIT.

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