Bio 3D Printing for Biomedical: Hydrogels for Actuator, Scaffold and Dressing

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Abstract

Recently, bio-3D printing technology has led to essential innovations in various areas such as tissue engineering, wound healing, and drug delivery in the fields of biomedicine and soft robotics. In this development, hydrogels have been attracting attention as bio-3D printing materials due to their unique physical and chemical properties. This seminar will deeply explore the characteristics of hydrogels and how they are utilized in biomedical and soft robotics applications such as actuators, scaffolds, and dressings.

In particular, hydrogels are ideal for the production of soft actuators based on their flexibility and biocompatibility, thereby opening up new possibilities in bio-robots and tissue engineering. At the same time, hydrogel scaffolds provide a three-dimensional environment for cell growth and tissue regeneration and can effectively mimic tissue structures in vitro. In addition, hydrogel-based dressings have excellent moisture retention and drug delivery functions, contributing to improving wound healing rates. This seminar will analyze the impact of hydrogel-based bio-3D printing technology on soft robots, scaffolds, and dressings compared to existing and past technologies, and highlight the potential for developing customized treatment solutions. In addition, the hydrogel materials used in bio-3D printing will be discussed.

In addition, this seminar will provide insight into how hydrogel bio-3D printing technology can provide an innovative manufacturing paradigm in the fields of biomedicine and soft robots, and explore the direction of future research and industrial applications.

CURRICULUM VITAE

Name:	Yong-Jin Yoon
Academic positions:	Associate Professor (Tenured)
Workplace:	Department of Mechanical Engineering, KAIST
Email:	yongjiny@kaist.ac.kr
Expertise:	Digital manufacturing for ceramic, metal and polymers, Design for additive manufacturing for drone and medical implants, AM and nano-fab hybrid manufacturing process for battery, fuel cell, and mobilities, AI-enabled green manufacturing process

Education History

[Doctorate]	2009	Stanford University in Mechanical Engineering
[Doctorate]	2009	minor, Stanford University in Management Science and Engineering
[Master]	2008	Stanford University in Electrical Engineering
[Master]	2005	Stanford University in Mechanical Engineering
[Bachelor]	2000	Korea University in Mechanical Engineering

Professional Background

8/2018-Present	Associate Professor, Department of Mechanical Engineering, KAIST
1/2024-Present	Adjunct Professor, Department of Electrical Engineering, KAIST
1/2024-Present	Adjunct Professor, Department of Semiconductor Systems Engineering, KAIST
9/2019-Present	Adjunct Professor, KAIST Institute for the NANOCENTURY, KAIST
1/2022-Present	Visiting Associate Professor, School of Mechanical & Aerospace Engineering, Singapore, NTU
3/2019-12/2021	Adjunct Associate Professor, School of Mechanical & Aerospace Engineering, Singapore, NTU
3/2018-2/2020	Visiting Professor, Graduate School of Technology Management, Kyunghee University
1/2010-8/2018	Assistant Professor, School of Mechanical & Aerospace Engineering, Singapore, NTU
9/2016-8/2018	Visiting Professor, Human Development Institute, Chungnam National University

Selected Awards and Honors

1.	2023	SC3DP 1st Additive Manufacturing Pitch Competition – Champion (Reshape4D), Singapore
2.	2022	Minister of Science and ICT Award – Best Tech Startup, Korea
3.	2022	Gold Prize in Research (1st'), Korean Society of 3D Printing in Medicine
4.	2021	Best Research Award, KCreS, Korea Ceramic Society
5.	2021	Best Research Award, Korean CDE Society
6.	2021	Bronze Prize in Research, Korea LED Optoelectronic Society

Selected Publications

1. Noh, J., Kim, P., **Yoon, Y.-J.**, 2025, "Nonlinear shock isolation using the bottleneck phenomenon near a saddle-node ghost", Mechanical Systems and Signal Processing, 223, 111889
2. Kim, I.-S., **Yoon, Y.-J.**, 2024, "Digital light processing 3D printing of porous ceramics: A systematic analysis from a debinding perspective", Additive Manufacturing, 93 (5), 104409
3. Ho, CMB., Kan, H., **Yoon, Y.-J.**, 2024, "Conductive rGO/PEGDA Hydrogel for Controllable Drug Release." International Journal of Precision Engineering and Manufacturing-Green Technology, 1-13
4. Sim, M.-S., Kim, D.-Y., **Yoon, Y.-J.**, Kang, S.-W., Beak, J., 2024, "Real-time Predicting the Low Temperature Performance of WLTC-based Lithium-Ion Battery Using an LSTM-PF Sequential Ensemble Model," in IEEE Access, 12, 90171-90180
5. Kim, S., Kim, E., Lee, W., Sim, M., Kim, I., Noh, J., Kim, J.-H., Lee, S., Park, I., Su, P.-C., Andreu, A., **Yoon, Y.-J.,** 2024, "Real-time in-process control methods of process parameters for additive manufacturing", Journal of Manufacturing Systems, 74, 1067-1090
6. Andreu, A., Lee, H., Kang, J., **Yoon, Y.-J.**, 2024, "Self-Healing Materials for 3D Printing", Advanced Functional Materials, 2315046.
7. Choi, JS., Noh, J., Choi, H., **Yoon, Y.-J.,** Park, WT., 2024, "Characterizing the Performance of a ResonanceBased MEMS Particle Sensor with Glass Beads." International Journal of Precision Engineering and Manufacturing-Green Technology, 11, 481–489