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Research Interests

Polymer chemistry, Biomaterial, Printed electronics, Wearable & implantable device, BioRobotics

Education

2009	Doctor of Engineering, Department of Life Science and Medical Bioscience, Waseda University

Professional Career

2010- 2012	Postdoctoral Research Fellow, Italian Institute of Technology
2012- 2013	Research Associate, Advanced Institute for Materials Research (AIMR), Tohoku University
2013- 2018	Assistant Professor, Department of Life Science and Medical Bioscience, School of Advanced Science and Engineering / Waseda Institute for Advanced Study, Waseda University
2015- 2019	Researcher, Precursory Research for Embryonic Science and Technology (PRESTO), JST
2018 - present	Associate Professor (Lecturer), School of Life Science and Technology, Tokyo Institute of Technology / Leading Initiative for Excellent Young Researchers (LEADER), JSPS

Scientific Activities

2005 -2015	Construction of polymeric nanosheets and their biomedical application
2015 - present	Integration of nano, bio, electronics for wearable and implantable device

Honors

2019	Biomaterials Science Emerging Investigators (Royal Society of Chemistry Journal)
2018	The Young Scientists' Prize for the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology (MEXT), Japan
2017	The Award for Young Investigator of Japanese Society for Biomaterials; Japanese Society for Biomaterials

Publications

1. Suematsu, Y., Tsai, Ya An., Takeoka, S., Franz, C.M., Arai, S. Fujie, T. J. Mater. Chem. B, 8, 6999-7008 (2020).
2. Yamagishi, K., Nakanishi, T., Mihara, S., Azuma, M., Takeoka, S., Kanosue, K., Nagami, T., Fujie, T. NPG Asia Mater., 11, 80 (2019).
3. Yamagishi, K., Kirino, I., Takahashi, I., Amano, H., Takeoka, S., Morimoto, Y., Fujie, T. Nat. Biomed. Eng., 3, 27-36 (2019).

Printed Nanofilm to Engineer Bioelectronic "Second Skin"

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Integration of flexible electronics into the living system is expected for advancing medical diagnostics and therapeutics. Such devices should be conformable to the physical and mechanical environment of our body, in which acquired biosignals should be wirelessly transmitted to external device for health-care management. In this regard, we have envisaged ultra-flexible wearable and implantable devices based on the polymer nanosheet technology. The polymer nanosheet shows tens- to hundreds-of-nanometer thickness close to the scale of biomembranes [1], in which various types of polymers (e.g., biodegradable polymers, conductive polymers, and elastomers) can be formed into the ultra-thin structure by spincoating, layer-by-layer and gravure coating processes. The free-standing nanosheet showed flexible and adhesive properties derived from ultra-small flexural rigidity (< 10-2 nN m). In this talk, nanosheet-based devices (namely, printed nanofilms) are introduced by combining nanosheet and printing technologies with variety of unique inks (Fig. 1) [2]. The printed nanofilm has been utilized as a "second skin" to engineer functional bioelectronic interface, such as ultra-conformable bioelectrodes for sports science [3] and plant biology [4], and wirelessly-powered, implantable optoelectronics for photodynamic cancer therapy [5].

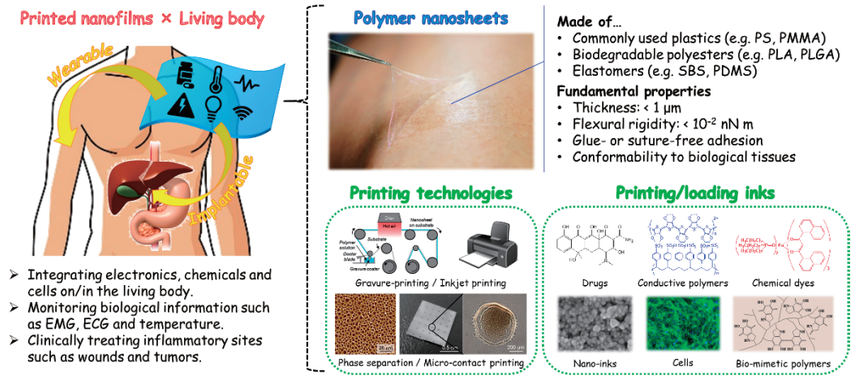

Fig 1. Printed nanofilms based on nanosheet technology. (Partially reproduced from Ref. 2.)

References

[1] T. Fujie, Polym. J., 48, 773 (2016).
[2] K. Yamagishi, S. Takeoka, T. Fujie, Biomater. Sci., 7, 520 (2019).
[3] K. Yamagishi, T. Nakanishi, S. Mihara, M. Azuma, S. Takeoka, K. Kanosue, T. Nagami, T. Fujie, NPG Asia Mater., 11, 80 (2019).
[4] H. Taniguchi, K. Akiyama, T. Fujie, B. Chem. Soc. Jpn., 93, 1007 (2020).
[5] K. Yamagishi, I. Kirino, I. Takahashi, H. Amano, S. Takeoka, Y. Morimoto, T. Fujie, Nat. Biomed. Eng., 3, 27 (2019).