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# ナノ材料を用いたフレキシブルデバイスシート

## Nanomaterial-Based Printed Flexible Device Sheets

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Flexible and/or stretchable devices, which enable to attach on a variety of surfaces including a human skin, are of great interests for one of next generation electronics. In particular, flexible sensors and transistors have been widely studied to move forward to realizing the flexible electronics using organic and/or inorganic materials. However, most of flexible devices with active components are still fabricated by using conventional semiconductor infrastructures that limit the device size and increase device cost per size. Thus, the realization of both macro-scale and low-cost device is still a challenge due to the difficulties of device fabrication on a flexible substrate without using the expensive infrastructure. To overcome this challenge, we have proposed macro-scale flexible sensors by developing nanomaterial-based printing techniques. We here introduce our recent progress on the printed flexible sensor sheets such as a strain sensor[1] and a temperature sensor[2]. Furthermore, macro-scale integrated multi-functional sensor devices such as artificial electronic skin[3] and whisker[1] are also demonstrated by considering the fabrication process and strain engineering. These devices were fabricated mainly using a screen printing method. Finally, flexible, low-power consumption complementary metal-oxide-semiconductor (CMOS) circuit is introduced as a proof-of-concept[4]. It should be noted that this flexible CMOS circuit is not fabricated by a fully printing method. I will discuss about the performance of printed sensor and flexible CMOS circuits and the demonstration of each device application as one of the possible concepts for the flexible electronics.

The techniques of the proposed printing methods to form nanomaterial-based thin films on flexible substrates should lead the field of macro-scale, low-cost, and high performance flexible electronics even if the exactly same method is not used for the practical application in the future.

**References**

[1] S. Harada *et al*. *ACS Nano*, **8**, 3921-3927 (2014). [2] W. Honda *et al. Adv. Funct. Mater.*, **24**, 3299-3304 (2014). [3] S. Harada *et al. ACS Nano*, **8**, 12851-12857 (2014). [4] W. Honda *et al. Adv. Mater.*, in press (2015).