Intrinsically Stretchable and Healable Semiconducting Polymer for Soft Transistor Application

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Developing a molecular design paradigm for conjugated polymers applicable to intrinsically stretchable semiconductors is crucial toward the next generation of wearable electronics. Current molecular design rules for high charge carrier mobility semiconducting polymers are unable to render the fabricated devices simultaneously stretchable and mechanically robust. In this talk, we would like to present a new design concept to address the above challenge, while maintaining excellent electronic performance. This concept (Figure 1) involves introducing chemical moieties to promote dynamic non-covalent crosslinking of the conjugated polymers. These non-covalent covalent crosslinking moieties are able to undergo an energy dissipation mechanism through breakage of bonds when strain is applied, while retaining its high charge transport ability. As a result, our polymer is able to recover its high mobility performance (> 1cm^2/Vs) even after 100 cycles at 100% applied strain. Furthermore, we observed that the polymer can be efficiently repaired and/or healed with a simple heat and solvent treatment. These improved mechanical properties of our fabricated stretchable semiconductor enabled us to fabricate highly stretchable and high performance wearable organic transistors. This material design concept should illuminate and advance the pathways for future development of fully stretchable and healable skin-inspired wearable electronics. [1]

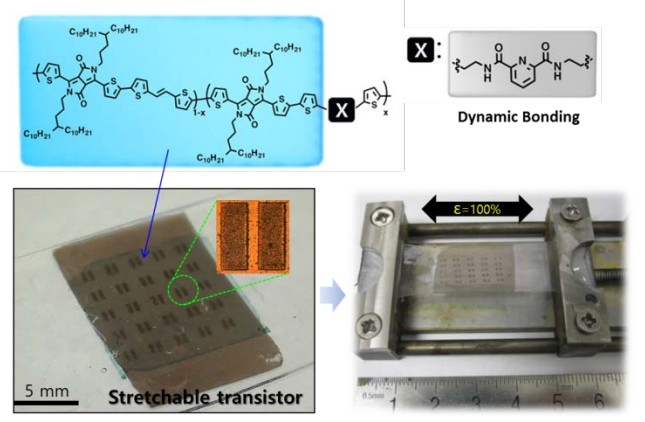

Figure 1: Design of stretchable and healable semiconducting polymer and their organic thin-film transistor device.

References:

[1] J. Y. Oh+, S. R. Gagné+, Y. C. Chiu+, A. Chortos, F. Lissel, G. J. N. Wang, B. C. Schroeder, T. Kurosawa, J. Lopez, T. Katsumata, J. Xu, C. Zhu, X. Gu, W. G. Bae, Y. Kim, L. Jin, J. W. Chung, J. B.-H. Tok and Z. Bao,* Nature, **539**, 411 (2016)

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