

Layered conjugated polymers with stimuli-responsive color-change properties

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Layered inorganic compounds have attracted much interest for their intercalation and exfoliation properties. In contrast to these “rigid” layered structures, exfoliation and intercalation chemistry of soft layered materials have not been fully studied toward exploration of the dynamic functions. Our group focuses on “soft” layered materials. Soft layered composites are efficiently exfoliated into the nanosheets.^{1,2} Recently, the designed organic layered materials are synthesized and applied to a superior electrocatalyst for hydrogen evolution reaction and active material of aqueous supercapacitor.^{3,4} In this symposium, I focus on a soft layered conjugated polymer, namely layered polydiacetylene (PDA), exhibiting the structure flexibility and dynamic properties (Figure 1).^{2,5-13} Intercalation of the guests controls flexibility of the layered conjugate polymer leading to the dynamic color-change properties. The stimuli-responsive color-change properties are controlled by the types of the intercalated guests. A variety of external stimuli, such as heat,⁵⁻⁸ light,^{9,10} and force,¹¹⁻¹³ are not only visualized but also quantified using the new layered composites based on PDA and their devices.

References

- [1] Y. Oaki,* *Chem. Lett.* **2021**, 50, 305.
- [2] Y. Oaki,* *Chem. Commun.* **2020**, 56, 13069.
- [3] S. Yano, K. Sato, J. Suzuki, H. Imai, Y. Oaki,* *Commun. Chem.* **2019**, 2, 97.
- [4] J. Suzuki, A. Ishizone, K. Sato, H. Imai, Y. J. Tseng, C. H. Peng, Y. Oaki,* *Chem. Sci.* **2020**, 11, 7003.
- [5] M. Okaniwa, Y. Oaki,* H. Imai, *Adv. Funct. Mater.* **2016**, 26, 2463.
- [6] Y. Ishijima, H. Imai, Y. Oaki,* *Chem* **2017**, 3, 509.
- [7] M. Takeuchi, H. Imai, Y. Oaki,* *ACS Appl. Mater. Interfaces* **2017**, 9, 16546.
- [8] M. Takeuchi, K. Gnanasekaran, H. Friedrich, H. Imai, N. A. J. M. Sommerdijk, Y. Oaki,* *Adv. Funct. Mater.* **2018**, 28, 1804906.
- [9] M. Takeuchi, H. Kawashima, H. Imai, S. Fujii,* Y. Oaki,* *J. Mater. Chem. C* **2019**, 7, 4089.
- [10] M. Nakamitsu, H. Imai, Y. Oaki,* *ACS Sens.* **2020**, 5, 133.
- [11] H. Terada, H. Imai, Y. Oaki,* *Adv. Mater.* **2018**, 30, 1801121.
- [12] K. Watanabe, H. Imai, Y. Oaki,* *J. Mater. Chem. C* **2020**, 8, 1265.
- [13] M. Nakamitsu, K. Oyama, H. Imai, S. Fujii,* and Y. Oaki,* *Adv. Mater.* **2021**, 33, 2008755.

Figure

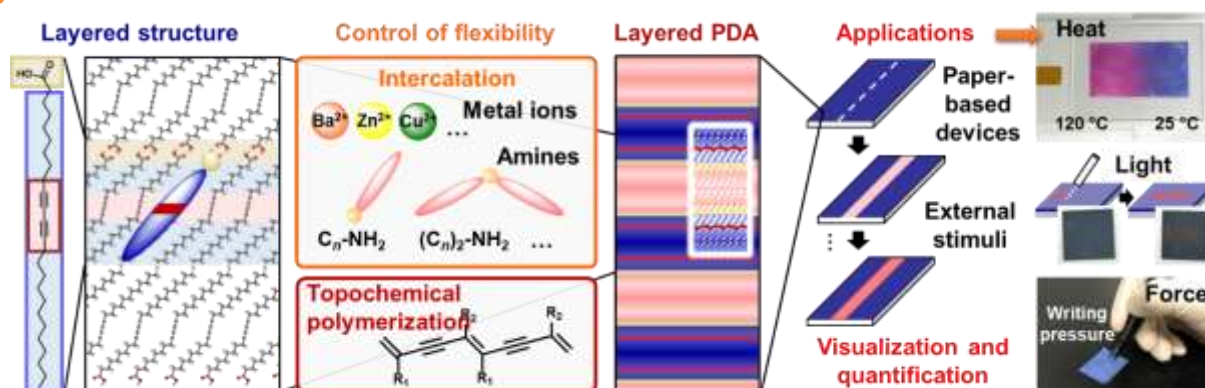


Figure 1. Schematic illustrations of layered polydiacetylene (PDA) with tunable stimuli-responsive color-change properties and applications to visualization and quantification of external stimuli, such as heat, light, and force.⁵⁻¹³