Mechanically Robust Supramolecular Polymeric Materials

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Polymers have modernized our life, but at the same time they have brought a catastrophic outcome to our living planet because of plastic pollutions.[1] Supramolecular polymers, in which monomers are linked by non-covalent bonds, give hope for the sustainable use of polymers.

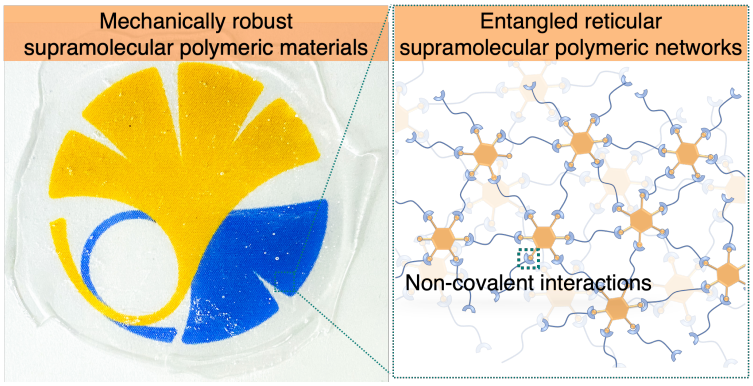

Fig.1. fabrication method for st supramolecular polymer glass.

So far, numerous efforts have been devoted to the development of supramolecular polymers in solution, and the basic principles of their assembly and the dynamic nature of their structures have been well established.[2] However, it is still a challenge to extend supramolecular polymers into materials comparable to plastics while maintaining their dynamic properties.

Here we report a conceptually new strategy for constructing mechanically strong supramolecular polymeric materials by linking two types of small molecules via non-covalent interactions. A series of unprecedented supramolecular polymeric materials was synthesized by mixing multitopic guanidium- and phosphate-based monomers at a given stoichiometric ratio, affording supramolecular polymeric materials that are transparent, mechanically strong with large Young's modulus (>17 GPa), processable and easy-to-recycle as monomers owing to their non-covalent nature. This work may stand for a new direction for polymer science.

Reference: 1. *Science* **2015**, *347*, 768; 2. *Isr. J. Chem.* **2020**, *60*, 1.