超分子架橋による有機-無機高分子の複合化

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Organic–inorganic materials have been widely utilized in various fields as multifunctional materials. Poly(dimethyl siloxane) (PDMS), a typical inorganic polymer, is blended with organic polymers for multifunctionality, but is immiscible with most polymers. We incorporated organic‐inorganic hybrid elastomers (PDMS-γCD-AAl ⊃ P(EA-HEMA) (*x*)) with movable and reversible crosslinks (**Fig. 1a**). Poly ethyl acrylate-r-hydroxy ethyl methacrylate (P(EA-HEMA)) penetrated the cavity of triacetylated γ-cyclodextrin (γCD), which was introduced into the side chains of PDMS-γCD-AAl. Allyl alcohol groups (AAl) of PDMS-γCD-AAl and HEMA in P(EA-HEMA) form hydrogen bonds between the polymers as reversible cross-links. *x* is molar ratio of HEMA in P(EA-HEMA). Introducing movable cross-links improved the compatibility of organic and inorganic polymers. The synergy of movable and reversible cross-links improved the toughness values (**Fig. 1b**). The design of PDMS-γCD-AAl ⊃ P(EA-HEMA) (*x*) incorporated cooperatively movable and reversible crosslinks to achieve high compatibility and mechanical properties[1].

Keywords : Movable cross-link, Hydrogen bond, Polymer blend, Mechanical properties, Structural analysis

有機高分子と無機高分子の複合化は、それぞれの特長を併せ持つ機能性材料を作製できるが、代表的な無機高分子であるポリジメチルシロキサン(PDMS)は、有機高分子と非相溶であるため、相分離し材料機能が失われる。本研究ではシクロデキストリン(CD)の空孔に高分子主鎖が貫通した可動性架橋と水素結合由来の可逆性架橋をPDMS とアクリレート系高分子(P(EA-HEMA) (*x*))間に導入し、混和性と靭性の向上に成功した [1]。

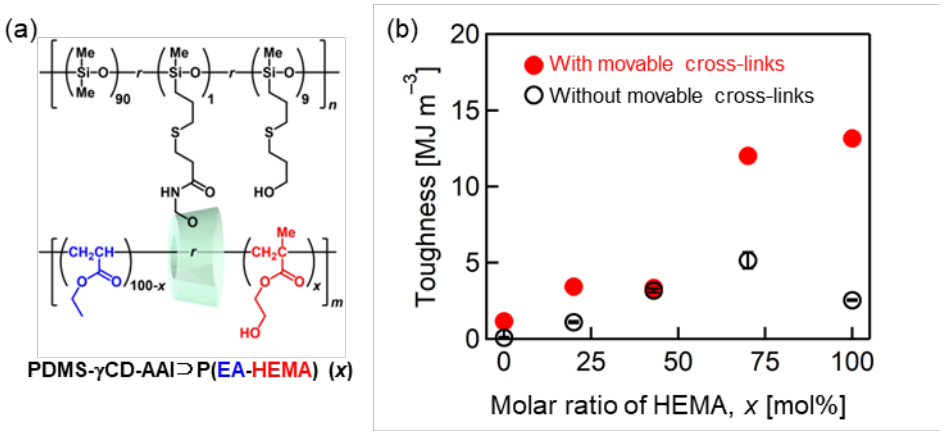

Figure 1. (a) Chemical structure and **(b)** toughness of PDMS-γCD-AAl⊃P(EA-HEMA) (*x*).

Ref. 1) N. Yamashita, K. Yamaoka, R. Ikura, Y. Takashima, et al., *Soft Matter* **2023**, *19*, 9074-9081.