Hydrophobic Hydrogen Bonding Motif for Strong Underwater Adhesion

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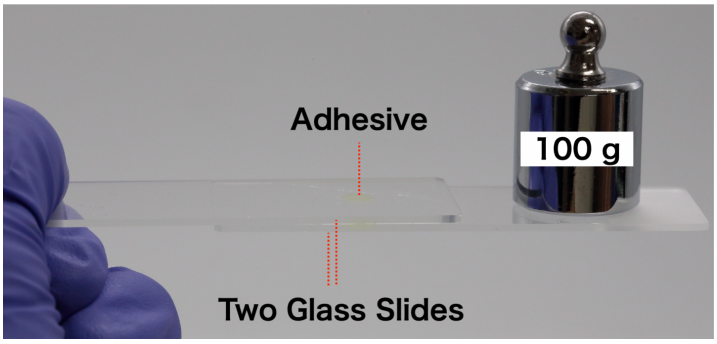
A variety of adhesives have been developed to date. However, adhesives that can be used under water have not been fully explored yet. This is because most adhesives rely its adhesiveness to polar functional groups, whose adhesive strength is largely weakened in water. Catechol units, inspired by mussel adhesive proteins, are known to be effective for underwater adhesion.[1] However, the catechol moiety is prone to be oxidized and thus cannot maintain high adhesive strength for a long time.

In 2018, our group reported a mechanically robust self-healable polymer glass comprising thiourea.[2] Based on this molecular structure, we embed photopolymerizable moieties into the polymer structure for the design of underwater adhesive. This molecule exhibited strong adhesiveness to polar surfaces such as glass in water. Furthermore, we found that this adhesive works not only in water but also in seawater. We discovered that the unique property of thiourea, which is hydrophobic but capable of hydrogen bonding, is the key to the realization of strong underwater adhesion.



(1) M. A. North, C. A. Del Grosso, and J. J. Wilker, *ACS Applied Materials & Interfaces* **2017**, *9*, 7866.
(2) Y. Yanagisawa, T. Nan, K. Okuro, and T. Aida, *Science*, **2018**, *359*, 72.