

The Concept of Polar Hydrophobicity for the Development of Adhesive Materials

(¹Graduate School of Engineering, University of Tokyo, ²RIKEN, ³Yamaguchi University)
 ○Kohei Kikkawa,¹ Abir Goswami,² Yosuke Sumiya,³ Takuzo Aida^{1,3}

Keywords: Adhesion, Polar Hydrophobicity, Polymer

Adhesives are used in a variety of fields, including mobility, medicine, packaging materials. Although adhesion is a seemingly simple phenomenon of bonding two materials together, various factors such as adhesive strength, application method, curing method, durability, water resistance, and the type of target substrate affect adhesion. Cohesive strength and interfacial strength are fundamental when considering the performance of adhesives. Cohesive strength is the intermolecular force between similar substances, and interfacial strength is the intermolecular force between different substances. In order to achieve the desired adhesive performance, a chemical bottom-up approach that controls the intermolecular interactions that determine cohesive strength and interfacial strength and creates adhesives with new molecular designs and motifs is very effective.

In this presentation, we report the development of new adhesives based on the concept of "polar hydrophobicity," which has not been used in the field of adhesives. Polar hydrophobicity is a concept that describes the unique property of fluorine compounds that provide a hydrophobic surface even though C–F bonds can form hydrogen bonds. By introducing this concept into adhesives for the first time, we achieved tough PTFE supramolecular adhesives and an all-underwater adhesive with excellent durability. Finally, we also found that thiourea works as a polar hydrophobic hydrogen bonding motif, that have never been reported other than fluorinated compound.

