Supramolecular Adhesives: Adhesion Promotion at Interfaces Facilitated by Quadruply Hydrogen-Bonding Modules

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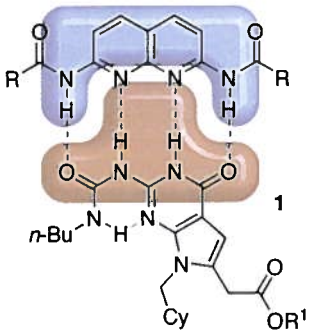
Due to their strength, selectivity and directionality, multiply hydrogen-bonded systems have gained widespread interest as synthetic molecular recognition units. Prompted by the recent development of high-affinity, high-fidelity quadruply hydrogen-bonding module pairs, such as our 7-deazaguanine urea (DeUG, **1**) and 2,7-diamido-1,8-naphthyridine (DAN, **2**), we sought to investigate the possibility of developing these toward adhesion promotion at materials interfaces. Although supramolecular interactions are ubiquitous in biological adhesion processes, few studies have been reported to date that exploit the potential of high-affinity, high-fidelity synthetic molecular recognition units as adhesion promoters.

We propose that the specific interaction of complementary, hydrogen-bonding recognition units can function as a strong, reversible interfacial junction. The use of polymers bearing multiple multivalent recognition units as the adhesive affords the possibility of tuning the strength of adhesion and enhancing the shear strength of the resultant joints due to chain entanglement, thus obviating the need for strictly inter-surface molecular recognition.

To test this hypothesis, monolayers of **1** on siliceous surfaces have been prepared and studied for use as the adherend. Polymers bearing varying amounts of the complementary unit, **2**, as a side-chain have been prepared for use as adhesives. The strength of the resulting interfaces has been investigated using standard lap-shear techniques and compared to appropriate control interfaces, as well as commercial adhesives. Potential applications of supramolecular adhesives such as these include polymer composites and microelectronics.



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