

高分子塗布を利用した反応性表面の構築と 異種材料接合への応用

Reactive Surfaces Prepared by Polymer Coating and Their Application to Dissimilar Material Bonding

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Abstract

Surface engineering based on click chemistry has attracted increasing attention as a versatile approach for functionalizing solid materials. In particular, strain-promoted azide-alkyne cycloaddition (SPAAC) enables highly selective covalent bond formation without catalysts or byproducts under mild conditions. This article reviews our recent studies on the development of Cu-free clickable surfaces and their application to the direct bonding of solid materials. A methacrylate-based copolymer bearing dibenzocyclooctyne (DBCO) groups was synthesized and applied to plastic substrates by simple coating processes. Surface segregation of the DBCO moieties enabled the formation of clickable surfaces, and the density of reactive groups was quantitatively evaluated and controlled. The resulting surfaces were used for biomolecule immobilization through Cu-free click reactions. Building on this platform, we developed “click bonding,” in which two solid surfaces displaying DBCO and azide groups are directly bonded through SPAAC-mediated covalent bond formation. Strong bonding was achieved for various combinations of materials, including plastics and glass, under diverse environments such as water, air, organic solvents, and vacuum. These studies demonstrate that coating-induced surface functionalization combined with click chemistry provides a powerful strategy for both molecular immobilization and direct bonding of dissimilar materials, expanding the potential of coating technologies in advanced surface engineering.

キーワード：表面機能化、高分子塗布、クリックケミストリー、直接接合、異種材料接合

Keywords：Surface functionalization, Polymer coating, Click chemistry, Direct bonding

1. はじめに

塗装・コーティング技術は、材料表面に新たな機能を付与するための重要な手法として広く利用されている。防食性、耐摩耗性、撥水性、接着性、生体適合性など、多様な機能が表面処理によって実現されてきた。一方で近年では、

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