195c Dramatic Stabilization of Proteins Adsorbed Onto C-60 Fullerenes

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Designing highly active and stable protein preparations is critical for a variety of applications including biosensors, biomedical devices, functional materials, and surface coatings. We demonstrate the ability to enhance protein function and stability by controlling its nanoscale environment. Activities of fullerene-enzyme conjugates were significantly higher than the native enzyme and enzymes adsorbed on other carbonaceous supports, when subjected to elevated temperatures and organic solvents. The degree of stabilization strongly correlates with the unique surface curvature of the nanoscale materials, which appears to reduce undesirable protein-protein interactions. The enhanced stability was exploited in the preparation of highly active polymer-nanocomposite films that were highly stable under harsh environments. The stable fullerene-protein conjugates represent a new generation of highly selective, active, and stable catalytic materials with a major impact on applications ranging from protein chips, vaccines, and biofuel cells to drug delivery.