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Nota di contenuto	Background -- Towards Metallic Butterfly Wing Scales -- Metal Scale Replicas Prepared via Electroless Deposition -- SERS Performance of Au

Scale Replicas -- SERS Mechanisms of Metal Scale Replicas -- Conclusions and Perspectives.

Sommario/riassunto

This book presents a method for replicating natural butterfly wing scales using a variety of metals for state-of-the-art applications requiring high surface-enhancement properties. During the past decade, three dimensional (3D) sub-micrometer structures have attracted considerable attention for optical applications. These 3D subwavelength metallic structures are, however, difficult to prepare. By contrast, the 3D superstructures of butterfly wing scales, with more than 175 000 morphologies, are efficiently engineered by nature. Natural butterfly wing scales feature 3D sub-micrometer structures that are superior to many human designs in terms of structural complexity, reproducibility, and cost. Such natural wealth offers a versatile chemical route via the replication of these structures into functional metals. A single versatile chemical route can be used to produce butterfly scales in seven different metals. These synthesized structures have the potential for catalytic (Au, Pt, Pd), thermal (Ag, Au, Cu), electrical (Au, Cu, Ag), magnetic (Co, Ni), and optical (Au, Ag, Cu) applications. Plasmon-active Au, Cu, Ag butterfly scales have exhibited excellent properties in surface-enhanced Raman scattering (SERS). The Au scales as SERS substrates have ten times the analyte detection sensitivity and are one-tenth the cost of their human-designed commercial counterparts (KlariteTM). Preliminary mechanisms of these surface-enhancement phenomena are also reviewed.