SILVER PLATED BUTTERFLY WING SCALES AND CICADA WINGS AS SUBSTRATES

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Abstract

Main constituent of the insect exoskeletons, wings or butterfly wing scales is chitin – a chemically resistant, colourless, and electrically non-conducting polysaccharide (from N-acetylglucosamine). Excellent physical and mechanical properties of chitin e.g. toughness, flexibility and temperature stability offer a possibility to use some highly specialized bio-materials as the components of substrates for SERS (Surface Enhanced Raman Spectroscopy). The biomimetic approach to preparation of submicro-structured materials appears to be successful in photonics, where particularly the “structural pigments” on butterfly wing scales are studied. The surfaces of wings of cicadas, periodically covered with nanopillars, were used as a stamps in nanoimprinting lithography [1]. We have developed a method for electroless silver plating on the superhydrophobic surfaces of butterfly scales and cicadas wings. We have obtained the compact, ultrathin silver layers which created metallic lustrous and uniformly nanocrystalline shield on chitinous cuticle. Thus modified bio-templates were successfully tested as substrates for spectroscopy based on surface enhanced Raman scattering. Good SERS spectra of 5,10,15,20-tetrakis(1-methyl-4-pyridyl)porphyrin in 1x10^{-7}M concentration have been obtained using confocal Raman microspectrometer LabRam HR800 (Horiba Jobin-Yvon, laser excitation 514.5 nm of Ar+ laser).


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