Sensors and Materials, Vol. 23, No. 5 (2011) 251–261
MYU Tokyo

S & M 0843

Liquid-Phase Formation of Silver Nanoparticles on a Glass Substrate Regulated by Gold Nanoparticles

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(Received February 1, 2010; accepted August 16, 2010)

Key words: nanoparticle, liquid-phase reduction, silver nanoparticle, gold nanoparticle, fluorescence enhancement

In this paper, we demonstrate the formation of uniformly distributed silver nanoparticles (NPs) regulated by gold NPs deposited in advance, and demonstrate their application to the enhancement of fluorescent signals. First, gold NPs were created by liquid-phase citrate reduction, and preferentially deposited onto surfaces chemically modified with 3-aminopropyl-trimethoxysilane (APTS). After the APTS was removed by oxygen plasma treatment, silver NPs were deposited onto the glass surface by a modified silver mirror reaction. Distribution of the silver NPs formed on the substrate was controlled by the reaction times of the gold and silver NP reduction processes. With gold NPs present, the silver NPs were more likely to deposit as isolated NPs than as aggregated NPs. This enabled the gold/silver NP substrates to achieve a significantly enhanced rhodamine-6G fluorescence, 8 times greater than that of a glass substrate on average, and greater than those of substrates with only silver or only gold NPs. The proposed gold and silver nanoparticle substrates are readily applicable to ultrasensitive bio/chemical detection technology.

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