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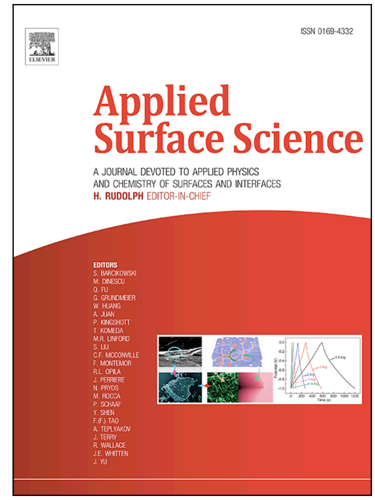

Short Communication

Enhanced ultraviolet absorption in diamond surface via localized surface plasmon resonance in palladium nanoparticles

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Enhanced ultraviolet absorption in diamond surface via localized surface plasmon resonance in palladium nanoparticles

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Abstract

Enhancement of ultraviolet absorption through localized surface plasmon resonance (LSPR) was realized by assembling of Pd nanoparticles on homoepitaxial diamond thin films. The result of UV-vis spectrum of Pd nanoparticles embedded in diamond surface demonstrated the LSPR at wavelength of 213nm, resulting in the improvement of ultraviolet absorption in diamond. The diamond ultraviolet photodetectors with and without Pd nanoparticles were fabricated and investigated. The results showed that the photoresponse from photodetector with Pd nanoparticles was 57.28 mA/W under 210 nm light at 5 V, which was three orders higher than that of detector without nanoparticles, and the UV/viable rejection ratio can reach to 4 orders of magnitude. This excellent performance should be attributed to LSPR in Pd nanoparticles, which was further confirmed by finite difference time domain (FDTD) simulation.

Keywords: Diamond; Nanoplasmonic; Ultraviolet photodetector; Nanoparticles.

1. Introduction

Localized surface plasmon resonance in metal nanostructures is widely used in the photovoltaic devices [1, 2], photodetectors [3, 4], sensing [5, 6] since the near-field of metal nanostructures and light absorption for semiconductor can be enhanced [6]. The noble metals, such as Au, Ag, are usually used as plasmonic material in the visible or near infrared regions of the spectrum [8, 9]. However, Au and Ag do not support good LSPR in the UV because their Im[ε] values become large as wavelength less 300nm, and low Fröhlich frequency (<4eV) [10, 11]. Pd, as a noble metal, has high melting point, good chemical stability and the most