Enhanced photoluminescence of polyfluoren copolymers with one-dimensional plasmonic structures

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1. Abstract

Photoluminescence of polyfluoren copolymers, a white-light material, was demonstrated to be enhanced by coupling with either localized or propagating modes of surface plasmon resonance (SPR). The silver grating structures with 50nm height were fabricated by e-beam lithography followed by etching, e-beam evaporation and lift-off process, shown in fig. 1. Over etching during the etching process leads to low aspect ratio of the one-dimensional structure, the sample shown in fig. 2(d), and form a continuous film which produced the propagating surface plasmon. Moreover, by effectively coupling the localized and propagating SPR, we can experimentally demonstrate that the photoluminescence of polyfluoren copolymers is enhanced by 10 to 16 times at different wavelengths, Line #4 in fig. 3, compared to enhancement by either single mode.

2. Figures

Fig. 1 Schematic illustrates experimental fabrication used as enhanced PL measurements with one-dimensional plasmonic structures. The sizes are not in proportion.

Fig. 2 SEM images of Ag one-dimensional plasmonic structures with the same constant height of 75nm and different periods of 1000 nm, 800 nm, 600 nm and 400 nm on silicon substrates.

Fig. 3 (a) PL spectrum of PF copolymer coupling with different period Ag one-dimensional plasmonic structure array on Si substrate. (b) PL enhancement factors transformed from fig. 3(a) by normalizing with the intensity of PF copolymer alone. Line #1 to #4 are corresponding to the structures in fig. 2(a) to 2(d), and the sample of Ag50 only contains a 50 nm Ag thin film on Si.

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