様式 8

論 文 内 容 要 旨

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学位論文題目	Fabrication of silver nanostructures with laser-induced chemical reaction (レーザー誘起化学反応による銀ナノ構造の作製)		

内容要旨

The thesis is divided into the following sections:

In Chapter 2, Based on Femtosecond laser direct writing technology, we studied the mechanism of laser induced reduction and plasmon-mediated process. By adding the Ag seeds, the problem of Agion exhaustion is solved and the processing efficiency is enhanced, which increases the processing efficiency through one-time scanning. Effective MEs can be easily achieved using a fabricating precursor containing Ag seeds. The applied laser power is remarkably reduced to one-tenth of that without Ag seeds, and the accelerated processing efficiency is mainly due to an enhanced MPA process. The MEs are pattern-controllable and size-tunable, exhibiting good continuity and alow RMS. As a representative application, the MEs-based OFETs were fabricated and exhibited good photoelectric response, and an on–off ratio of 200 can be achieved .That is, this method displays a great potential in realizing high quality MEs that can be applied in multiple kinds of microdevices and microcircuits.

In Chapter 3, Reduction of silver is easy to understand and even processed by femtosecond laser. Inspired from the mechanism, we learned that silver seeds are first reduced in the solution, which is very active to interact with other elements or compounds. To get more active silver structures and widen the fabrication methods, we tried experiments for fabricating silver compound by adding some other elements into the silver precursor. Based on this idea, we successful fabricate silver vanadium oxide flowers on the fixed position. Different patterns of SVO have been obtained just as the designed. SVO exhibited great potential for electrochromic devices, cathodic electrodes for lithium batteries, catalysts, gas sensors, and electrical and optical devices.

In Chapter 4, We have proposed a novel method for revealing large-area silver nanocrystal patterns for high sensitive and uniform surface-enhanced Raman spectrosco py(SERS) detection. By combining the nano-tailoring method with the soft template method, rapid galvanic battery reaction was controlled to obtain nanocrystal gratings and two-dimensional arrays. Those nanocrystals with sizes between 30 and 200 nm and with gaps between 10 and 20 nm can both be determined by period and etching time. Rh6G was used as a detection molecule, and the intensity linearly increased with the logarithm of concentration from 10^{-8} mol/L to 10^{-11} mol/L. Therefore, the optimized silver arrays have great potential for ultrasensitive molecular sensing in terms of its high SERS enhancement ability, favorable stability, and excellent reproduc ibility. The nanocrystal also shows perfect programmable ability, thereby allowing its wide application in light control and surface plasma resonance imaging.

The dissertation is concluded in Chapter 5.