Direct Writing of Ag Nanowire Using Multiphoton Absorption Nanofabrication Method

Gui-Cang He[1,3], Mei-Ling Zheng[1*],Xian-Zi Dong[1], Yuan-Yuan Zhao[1,3], Xuan-Ming Duan[1,2] and Zhen-Sheng Zhao[1*]

[1]Laboratory of Organic NanoPhotonics, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, No. 29, Zhongguancun East Road, Beijing 100190, P. R. China
[2]Chongqing Institute of Green and Intelligent Technology, Chinese Academy of Sciences, No.266 Fangzheng Ave, Shuitu technology development zone, Beibei District, Chongqing 400714, P. R. China
[3]University of Chinese Academy of Sciences, Beijing 100190, P. R. China
E-mail: Zhengmeiling@mail.ipc.ac.cn, Zhaozhsh@mail.ipc.ac.cn

1. Introduction

Over the past few decades, there has been increasing attention on metal nanofabrication due to its promising property of electrics, thermology and optics. At the same time, the increasing demand for powerful integrated circuits and other applications have spurred remarkable progress in metal nanofabrication. In order to realize the two-dimensional (2D) or 3D metal structure fabrication and improve the structures function and morphology, various nanofabrication methods have been proposed. For example, UV excimer laser annealing,[1] UV roll imprint lithography,[2] scanning probe lithography[3] and E-beam lithography.[4] But those nanofabrication methods either need very complicated pre-process, or the cast is too expensive to afford. As a direct write technique, multiphoton absorption nanofabrication has great potential in metal nanofabrication.

2. Result and discussion

In this study, we set up a multiphoton absorption nanofabrication experiment equipment and fabricated Ag nanowire on the glass substrate under different experimental conditions. The excitation source was a commercial Ti:sapphire laser (Tsunami, Spectra-Pysics) that produced pulses with a repetition rate of 80 MHz, a center wavelength of 780 nm, and a duration of 80 fs. The laser beam was tightly focused by a 100 × oil-immersion objective lens with a high numerical aperture (N.A. = 1.45, Olympus). We found that the Ag nanowire width was influenced obviously by laser power, scanning speed and focus position. As shown in Figure 1a, the width of Ag nanowire decreased with decreasing laser power, and at a laser power of 1.34 mW, a 250 nm line was obtained. The nanowire width decreased with increasing scanning speed as（Fig 1b）, and the nanowire width increased with increasing focus relative position（Fig 1c）.

3. Conclusion

We have studied the experimental parameter influence of nanowire width, and found the nanowire width was influenced obviously by laser power, scanning speed and focus relative position.

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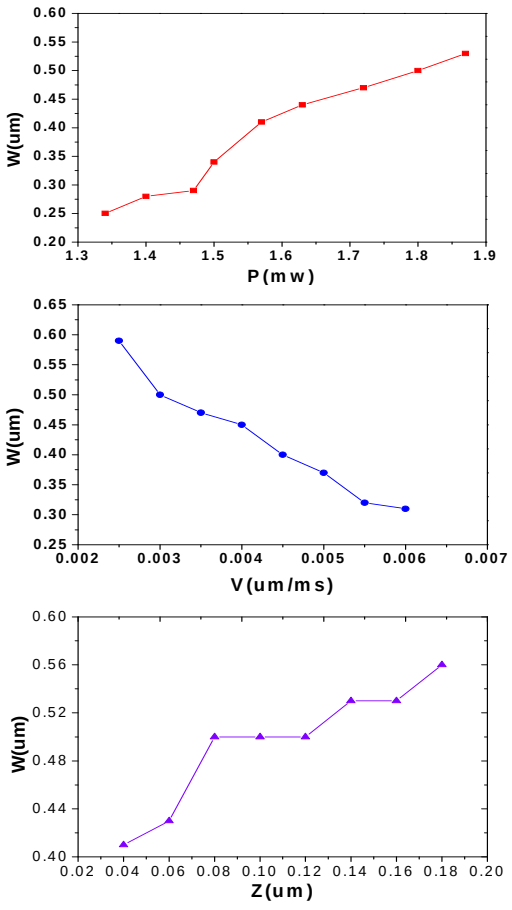

Fig 1. The curve of Ag nanowire width versus (a) laser power, (b) scanning speed and (c) focus relative position.

References

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