

Method formation of silicon nanowires for electron field emission

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Silicon nanowires (NWs) can be used in emission displays, single-electron transistors, as electron emitters in induced vacuum electronics [1].

The main purpose of this work was to form silicon NW by metal assisted chemical etching (MACE) and investigate their structural and field emission properties.

MACE is promising, cost-effective method to grow NWs. The initial material Si n-type was etched in solution (HF: H₂O = 1:20). Gold Au films $d = 10$ nm was sputtered on the cleaned Si surface and annealed in argon atmosphere at a temperature of 800 °C for 2 h to form gold nanoclusters. Then samples were etched in (12 ml 48% HF + 0.103M of AgNO₃) solution at $t = 15$ min, $t = 30$ min, $t = 45$ min, washed in HNO₃ acid and dried. As a result, the silicon vertical NWs were formed edge. HRSEM images of formed structure are shown in Fig.1.

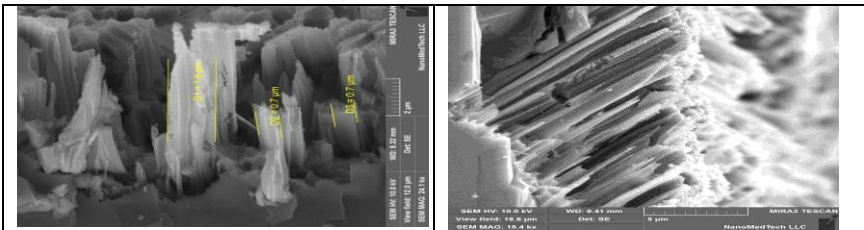


Fig.1. HRSEM images of Si NWs formed by MACE (t=30min).

The effective electron field emission (EFE) was observed from Si NWs formed by MACE. Research of EFE has shown that there are two regions on the curves in terms of the F-N coordinates. This was explained by different height of NWs.

1.Litovchenko V. and Evtukh A. Vacuum nanoelectronics, in Handbook of Semiconductor Nanostructures and Nanodevices, Spintronics and Nanoelectronics Vol. 3, edited by A. A. Balandin and K. L. Wang.- American Scientific Publishers, Los Angeles, 2006.- Vol. 3.- 153–234 p