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DNA-Templated Cu and AuNPs Conjugated Conductive Nanowires

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Abstract

Because of limitations of the top down method, many researchers have tried to replace top down method with bottom up method. One of the promising materials of bottom up method is the DNA which is have self-assembled characteristic. Moreover, DNA molecules is promising building block to obtain highly ordered electronic components for nanocircutitry and nanodevices because of its very flexible length controllability, nanometer-size diameter about 2 nm, and the site of negatively charged phosphate group which make possible to bind positively charged nanoparticles and metal ions. Because of these properties of DNA molecules, DNA-templated nanowires have been widely researched. DNA-templated nanowire which was formed by electronic interaction between positively charged nanoparticles and DNA has chain-like structures. Because of this structural characteristic of AuNPs-DNA strands, the nanowire has low conductivity. In this work, we formed continuous nanowires through attaching gold nanoparticles on DNA and subsequent treatment with copper metalization. DNA was aligned on the APTES coated silicon substrate. Positively charged AuNPs were attached to the backbone of DNA molecules. The $Cu(NO_3)_2$ solution was deposited on substrate aligned DNA-AuNPs. Subsequently, an ascorbic acid solution was added as reducing agent. We could confirm continuous nanowires were formed on the silicon substrate. Aligned nanowires were measured by AFM. Electrical characteristic was measured using the conducting probe AFM. We look forward that the conjugated conductive nanowire can be widely used for various biosensor and electronic devices.