DNA SCAFFOLD BASED NANOSCALE ANTENNA

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ABSTRACT

In this poster we present design and implementation of DNA biostructure as a scaffold for nanoscale devices. Custom shapes formed by programmable DNA self assembly can be used to engineer nanoscale devices such as a biological antenna. Detailed protocol to develop nanostructure and protocol to active reasonable conductivity of such biological structures is also presented here.

INTRODUCTION

Advancement in nano technology and fabrication techniques have provided researchers with the capability to build structures with sound electrical and thermal properties. Nanotechnology has been used in sensors and sensor-related technology, and is still considered as one of the most promising research area in medical science. For years, advancement in this area is hindered due to the unavailability of economical fabrication processes for realization of structures with suitable electrical properties. Several techniques such as lithography with photons, particles, and scanning probes, self-assembly, template deposition, conductive ink, and nano printing have been used to achieve various levels of integration and success. DNA based nanostructures and advances in DNA origami techniques have shown great potential in fabrication of nanostructures and devices. Though a large number of DNA origami structures have been reported, very few applications of DNA structures have been presented.

Experimental Procedures

To minimize the effect of nonadhesion of Ag to the fabric, abrasion and laundering on the fragility of Ag/AgCl electrode, we have developed following experimental method:

- We are using polyurethane coated fabrics in the electroless process.
- Deposition occurs in an aqueous solution containing silver metal ions and $AgNO_3$ as a reducing agent.
- Entire surface is wetted during the electroless, which assure good conductivity and uniform electrical properties regardless of geometries is a major advantage of this process [3, 4].
- Fabric samples, cotton and polyurethane , were chosen. The characteristics of the fabric specimens were summarized in Table(1).

Specimen	Content cm^2	Size (mm)	Weight (g)	Thickness (mm)	Color
Polyurethane	Plain 5 *5	50 × 50	4.87	0.44	White

Fig 1 – specification of plain

Experimental Procedures

- Surface of the fabric needs to act as a catalyst.
- A smooth deposition is obtained if the metal deposited by autocatalysis acts as a catalyst (Vaskelis 1999, Othmer 1995).
- Based on the method of chemical silver plating for non-metal substrates (Zeng 2002), the following steps were employed in the experiment:

Pretreatment → Sanitation → Plating → Activation → Post Treatment

MATERIALS AND METHOD

- Polyurethane rinsed in 5% detergent at room temperature for 20 minutes.
- Specimens sensitization (Surface act as a catalyst)
- Activation with active ions
- Cleaning with deionized water
- The pre-treated fabric samples were finally put in the chemical plating solution, which contained both Solution C and Solution D. In the experiment, the ratio of Solution C / Solution D is 1:3 in volume (See figure below)
- After chemical silver plating, the samples had to be rinsed in deionized water immediately.

item		solution
Cleaning	Solution A	5% detergent with water;
Sensitization	Solution B	1.5g stannous chloride ($SnCl_2 .2H_2O$); 1.5mL hydrochloric acid
Plating	Solution C	1.8g silver nitrate ($AgNO_3$); **1.g sodium hydrate (NaOH)**
Cleaning again	Solution D	Specimen rinsed in large volume of deionized water

Fig2– table for procedure

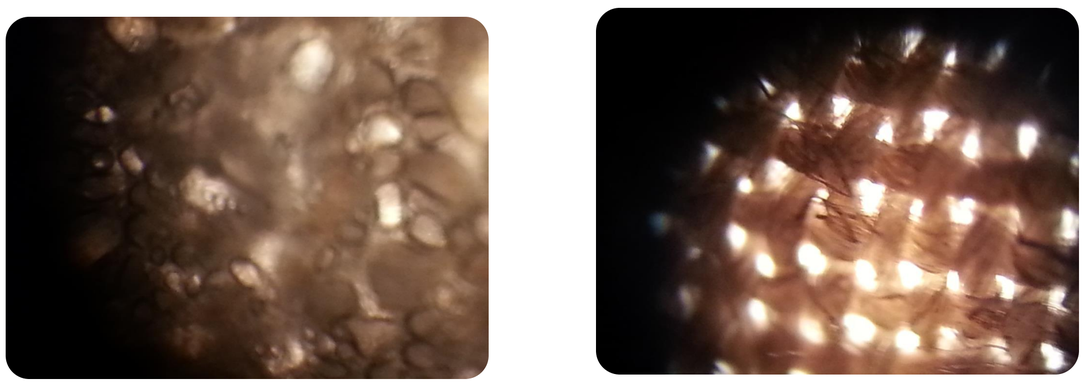

Fig 3 – before and after deposition

CONCLUSION

There are many advantages of using metal plated textiles in wearable electronics such as no reaction with the skin, reusability, comfort and mobility.
we applied a polyurethane (PU) sealing so that metal plating is durable even during laundering, which clothing materials are usually subjected to.
Stretching and physical activities have minimal effect on the performance of such electrodes.
Integrated with nanostructure conformal antenna, such electrodes, can used with wireless transmitter to send data to any external device for remote health monitoring, telemedicine and health delivery

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