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## Enhancement of electrode design for non-invasive stimulus application (Conference Paper)

Azman, A.W. ✉, Ariff, S.M. ✉, Azman, M.F. ✉, Ramli, H.A.M. ✉

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### Abstract

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Existing electrodes can be classified into two categories which are invasive and non-invasive electrodes. The non-invasive electrodes can be further classified into wet or dry electrodes. Most of the off-the-shelf electrodes are made from rigid substrates which have the high level of motion artifacts. To overcome this motion artifact, flexible electrodes have been slowly introduced in the market. Flexible electrodes can be made from various types of material such as the substrate. This paper presents a work on designing a new flexible dry electrodes using poly(3,4-ethylenedioxythiophene) polystyrene sulfonate and silver by means of dispenser printing technology. Polyester cotton fabric was selected as the substrate in this electrode designed. Results from the experiment show that the conductivity of the proposed flexible electrode is comparable with the conventional pre-gelled electrode when applied to an electrical stimulator device. Eight out of ten subjects under test described no difference in comfort between the proposed electrodes and pre-gelled electrodes. © 2017 IEEE.

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Electrical stimulation PEDOT PSS Silver nanoparticles

### Indexed keywords

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Engineering uncontrolled terms: Electrical stimulations Electrical stimulators Flexible electrodes PEDOT Poly-3,4-ethylenedioxythiophene Polyester cotton fabric Polystyrene sulfonate Printing technologies

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for monitoring biopotential  
Chen, Y. , Pei, W. , Chen, S.  
(2013) 8th Annual IEEE  
International Conference on  
Nano/Micro Engineered and  
Molecular Systems, IEEE NEMS  
2013

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#### References (12)

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- 1 Keyun, C.L.R., Zhipeng, C., Chengfeng, P., Wei, Z., Lelun, J.  
Fabrication of micro-needle electrodes for bio-signal recording by a magnetization-induced self-assembly method  
(2014) *Sensors*
- 2 Forvi, E., Bedoni, M., Carabalona, R., Soncini, M., Mazzoleni, P., Rizzo, F., O'Mahony, C., (...), Gramatica, F.  
Preliminary technological assessment of microneedles-based dry electrodes for biopotential monitoring in clinical examinations  
(2012) *Sensors and Actuators, A: Physical*, 180, pp. 177-186. Cited 48 times.  
doi: 10.1016/j.sna.2012.04.019  
[View at Publisher](#)
- 3 Meziane, N., Webster, J.G., Attari, M., Nimunkar, A.J.  
Dry electrodes for electrocardiography ([Open Access](#))  
(2013) *Physiological Measurement*, 34 (9), pp. R47-R69. Cited 81 times.  
[http://iopscience.iop.org/0967-3334/34/9/R47/pdf/0967-3334\\_34\\_9\\_R47.pdf](http://iopscience.iop.org/0967-3334/34/9/R47/pdf/0967-3334_34_9_R47.pdf)  
doi: 10.1088/0967-3334/34/9/R47  
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- 4 Howell, B.  
(2015) *Design of Electrodes for Efficient and Selective Electrical Stimulation of Nervous Tissue*

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5 Alex Gong, C.-S., Syu, W.-J., Lei, K.F., Hwang, Y.-S.  
Development of a flexible non-metal electrode for cell stimulation and recording  
(Open Access)  
  
(2016) *Sensors (Switzerland)*, 16 (10), art. no. 1613. Cited 6 times.  
<http://www.mdpi.com/1424-8220/16/10/1613/pdf>  
doi: 10.3390/s16101613  
  
View at Publisher

---

6 Orrill, M., LeBlanc, S.  
Printed thermoelectric materials and devices: Fabrication techniques, advantages, and challenges  
(2016) *Applied Polymer Science*, August

---

7 Zhang, T.  
Methods for fabricating printed electronics with high conductivity and high resolution  
(2014) *The University of Western Ontario, Ontario, Electronic Thesis and Dissertation Repository 1842*

---

8 Ahmadi, S., Asim, N., Alghoul, M.A., Hammadi, F.Y., Saeedfar, K., Ludin, N.A., Zaidi, S.H., (...), Sopian, K.  
The role of physical techniques on the preparation of photoanodes for dye sensitized solar cells (Open Access)  
  
(2014) *International Journal of Photoenergy*, 2014, art. no. 198734. Cited 11 times.  
doi: 10.1155/2014/198734  
  
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---

9 Zhao, Z., Richardson, G.F., Meng, Q., Zhu, S., Kuan, H.-C., Ma, J.  
(2015) *PEDOT-based Composites As Electrode Materials for Supercapacitors*  
UK

---

10 Khan, S., Ul-Islam, M., Khattak, W.A., Ullah, M.W., Park, J.K.  
Bacterial cellulose-poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) composites for optoelectronic applications  
  
(2015) *Carbohydrate Polymers*, 127, pp. 86-93. Cited 28 times.  
[http://www.elsevier.com/wps/find/journaldescription.cws\\_home/405871/description#description](http://www.elsevier.com/wps/find/journaldescription.cws_home/405871/description#description)  
doi: 10.1016/j.carbpol.2015.03.055  
  
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---

11 (2004) *Nano Silver Manufacturing SDN Bhd*  
June SilverSol™  
<http://www.nanosilver.com.my/>

---

12 Vaithilingam, J., Saleh, E., Tuck, C., Wildman, R., Ashcroft, I., Hague, R., Dickens, P.  
3D-inkjet printing of flexible and stretchable electronics  
(2015) *Nottingham*. Cited 2 times.

---

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