

Document details

[< Back to results](#) | 1 of 1[Export](#) [Download](#) [Print](#) [E-mail](#) [Save to PDF](#) [Add to List](#) [More... >](#)[Full Text](#) [View at Publisher](#)Indonesian Journal of Electrical Engineering and Informatics
Volume 5, Issue 4, December 2017, Pages 295-303

Characterization of screen printed Ag-PDMS flexible electrode for electrical muscle stimulation (EMS) (Article)

Ibrahim, S.N. [✉](#), Rahman, F.A., Rosli, S.

International Islamic University Malaysia, Department of Electrical and Computer Engineering, Kulliyyah of Engineering, International Islamic University Malaysia (IIUM), Jalan Gombak, Kuala Lumpur, Malaysia

Abstract

[View references \(10\)](#)

Electrical Stimulation is vital for maintaining muscle tone and strength particularly in improving muscle conditions. However, commonly used electrodes for muscle stimulation are flat, solid and have a fixed curvature and therefore cannot conform to the surface of the body. In this paper, a newly developed silver (Ag)- Polydimethylsiloxane (PDMS) flexible electrode for electrical muscle stimulation was developed. The electrodes were fabricated using screen printing for both single and array designs. The Ag-PDMS composite was developed to allow electrode pattern to be transferred properly on the PDMS substrate because due to same material property. Subsequently, the Ag-PDMS sheet resistance (R) which related to the conductivity of the electrode, was characterized. The R increases each time strain was given to the substrate (0.1cm in each test) with the initial value of 0.7Ω and 75Ω for single and array electrode respectively. To evaluate the functionalities of the electrodes, the Mechanomyogram (MMG) signals were measured by using an equipment called USBamp and a commercial Electrical Muscle Stimulator. Results show that the functionality of the fabricated single electrodes were comparable to the commercial one. © 2017, Institute of Advanced Engineering and Science. All rights reserved.

Author keywords

Ag-PDMS EMS MMS Screen printing Stretchable electrode

ISSN: 20893272

Source Type: Journal

Original language: English

DOI: 10.11591/ijeel.v5i4.363

Document Type: Article

Publisher: Institute of Advanced Engineering and Science

References (10)

[View in search results format >](#) All [Export](#) [Print](#) [E-mail](#) [Save to PDF](#) [Create bibliography](#)

- 1 Huang, G.-W., Xiao, H.-M., Fu, S.-Y.
Wearable Electronics of Silver-Nanowire/Poly(dimethylsiloxane) Nanocomposite for Smart Clothing

(2015) *Scientific Reports*, 5, art. no. 13971. Cited 39 times.www.nature.com/srep/index.html

doi: 10.1038/srep13971

[View at Publisher](#)

- 2 Bhore, S.S.
Formulation and Evaluation of Resistive Inks for Applications in Printed Electronics
http://scholarworks.wmich.edu/masters_theses

Metrics [?](#) [View all metrics >](#)

1 Citation in Scopus

1.92 Field-Weighted
Citation ImpactPlumX Metrics [v](#)Usage, Captures, Mentions,
Social Media and Citations
beyond Scopus.

Cited by 1 document

An analysis of a flexible dry
surface electrodesAzman, A.W. , Azman, M.F. , Ariff,
S.M.(2018) *Indonesian Journal of
Electrical Engineering and
Computer Science*[View details of this citation](#)Inform me when this document
is cited in Scopus:[Set citation alert >](#)[Set citation feed >](#)

Related documents

Low cost integration of microwire
electrodes into silicone
elastomeric devices using
modified xurographic methodsLiu, J. , Mahony, J.B. ,
Selvaganapathy, P.R.
(2016) *20th International
Conference on Miniaturized
Systems for Chemistry and Life
Sciences, MicroTAS 2016*An interstitial fluid transdermal
extraction chip with vacuum
generator and volume sensor for
continuous glucose monitoringYu, H. , Li, D. , Ji, Y.
(2013) *Key Engineering Materials*An integrated microfluidic
system for interstitial fluid

- 3 Niu, X., Peng, S., Liu, L., Wen, W., Sheng, P.
Characterizing and patterning of PDMS-based conducting composites

(2007) *Advanced Materials*, 19 (18), pp. 2682-2686. Cited 202 times.
doi: 10.1002/adma.200602515

[View at Publisher](#)

- 4 Yuan, W., Gu, W., Lin, J., Cui, Z.
Printed flexible and stretchable hybrid electronic systems for wearable applications

(2016) *2016 6th Electronic System-Integration Technology Conference, ESTC 2016*, art. no. 7764474.
ISBN: 978-150901402-6
doi: 10.1109/ESTC.2016.7764474

[View at Publisher](#)

- 5 Larmagnac, A., Eggenberger, S., Janossy, H., Vörös, J.
Stretchable electronics based on Ag-PDMS composites

(2014) *Scientific Reports*, 4, art. no. 7254. Cited 53 times.
www.nature.com/srep/index.html
doi: 10.1038/srep07254

[View at Publisher](#)

- 6 Wang, Z.
(2011) *Polydimethylsiloxane Mechanical Properties Measured by Macroscopic Compression and Nanoindentation Techniques*. Cited 29 times.
University of South Florida

- 7 Sc, C., Yu, C., Cl, L., Kuo, C., St, H.
(2007) *Design of Surface Electrode Array Applied for Hand Functional Electrical Stimulation in the Variation of Forearm Gesture*, 24 (23), p. 24.

- 8 Guo, H., Tang, J., Zhao, M., Zhang, W., Yang, J., Zhang, B., Chou, X., (...), Zhang, W.
Highly Stretchable Anisotropic Structures for Flexible Micro/nano-electrode Applications

(2016) *Nanoscale Research Letters*, 11 (1), art. no. 112, pp. 1-7. Cited 6 times.
<http://www.springer.com.ezlib.iium.edu.my/materials/nanotechnology/journal/11671>
doi: 10.1186/s11671-016-1324-x

[View at Publisher](#)

- 9 Yu, H.K.
Copper micro-labyrinth with graphene skin: New transparent flexible electrodes with ultimate low sheet resistivity and superior stability

(2016) *Nanomaterials*, 6 (9), art. no. 161. Cited 2 times.
<http://www.mdpi.com/2079-4991/6/9/161/pdf>
doi: 10.3390/nano6090161

[View at Publisher](#)

- 10 Syed, A.A., Duan, X.-G., Khizer, A.N., Mengli, M., Kong, X., Huang, Q.
Design and Implementation of Probe Driver Teleoperative Force Feedback System
(2014) *Indonesian Journal of Electrical Engineering and Computer Science*, 6, pp. 4215-4221.

transdermal extraction

Yu, H.X. , Li, D.C. , Roberts, R.C.
(2011) *2011 16th International Solid-State Sensors, Actuators and Microsystems Conference, TRANSDUCERS'11*

[View all related documents based on references](#)

[Find more related documents in Scopus based on:](#)

[Authors >](#) [Keywords >](#)

About Scopus

- [What is Scopus](#)
- [Content coverage](#)
- [Scopus blog](#)
- [Scopus API](#)
- [Privacy matters](#)

Language

- [日本語に切り替える](#)
- [切换到简体中文](#)
- [切换到繁體中文](#)
- [Русский язык](#)

Customer Service

- [Help](#)
- [Contact us](#)

ELSEVIER

[Terms and conditions](#) [Privacy policy](#)

Copyright © 2018 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

Cookies are set by this site. To decline them or learn more, visit our [Cookies page](#).

 RELX Group™