Accepted Manuscript

Development of printed and flexible dry ECG electrodes

Amer Abdulmahdi Chlaihawi, Binu Baby Narakathu, Sepehr Emamian, Bradley J. Bazuin, Massood Z. Atashbar

PII: S2214-1804(18)30025-4
DOI: doi:10.1016/j.sbsr.2018.05.001
Reference: SBSR 229

To appear in: *Sensing and Bio-Sensing Research*

Received date: 15 March 2018
Revised date: 1 May 2018
Accepted date: 3 May 2018

Please cite this article as: Amer Abdulmahdi Chlaihawi, Binu Baby Narakathu, Sepehr Emamian, Bradley J. Bazuin, Massood Z. Atashbar , Development of printed and flexible dry ECG electrodes. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sbsr(2017), doi:10.1016/j.sbsr.2018.05.001

Development of Printed and Flexible Dry ECG Electrodes

Amer Abdulmahdi Chlaihawi[1,2,*] amerabdulmahdi.chlaihawi@wmich.edu**, Binu Baby Narakathu[1], Sepehr Emamian[1], Bradley J. Bazuin[1], and Massood Z. Atashbar[1]**

[1]Department of Electrical and Computer Engineering, Western Michigan University, Michigan-49008, USA

[2]Department of Electrical Engineering, University of Kufa, Najaf, Iraq

[*]Corresponding author at: Address: 4601 Campus Drive, Western Michigan University, Department of Electrical and Computer Engineering, Kalamazoo, Michigan - 49008

ABSTRACT

Printed, flexible and wearable dry electrodes for monitoring electrocardiogram (ECG) signals, without any skin preparation and use of wet gel, has been developed. Silver (Ag) flake ink was screen printed on a flexible polyethylene terephthalate (PET) substrate to fabricate the dry ECG electrode. Multi-walled carbon nanotube (MWCNT)/ polydimethylsiloxane (PDMS) composite, as a conductive polymer, was then deposited on the printed Ag electrode by using a bar coating technique. The performance of the printed electrodes was investigated by testing the MWCNT/PDMS composite conductivity and measuring the electrode-skin impedance for electrode radii varying from 8 mm to 16 mm. It was observed that the dry ECG electrode, with the largest area, demonstrated better performance, in terms of MWCNT/PDMS composite conductivity, ECG signal intensity and correlation when compared to a commercial wet silver/silver chloride (Ag/AgCl) electrode. In addition, the capability of the dry ECG electrodes for monitoring ECG signals in both the relaxed sitting position and while the subject is in motion, was also investigated and the results were compared with a wet Ag/AgCl ECG electrode (T716). While the subject is in motion, the printed dry electrodes were less noisy and