

Published: 07 June 2022

# Synthesis and characterization of different graphite/chitosan ink ratio composition towards flexible strain sensor performance

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*Journal of Materials Science: Materials in Electronics* (2022) | [Cite this article](#)  
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## Abstract

Flexible and stretchable strain sensors are getting vast attention to be implied in various wearable devices application. However, most conventional strain sensor is having limitations in achieving both high stretchability and sensitivity. Selection of materials for conductive fillers and binders are crucial in producing the stretchable ink for strain sensors. Biopolymer materials such as chitosan started to be implied in various application such as gas sensor and electrochemical sensor. Chitosan has advantages to be a good binder as it exerts significant physical properties. Conductive fillers such as graphite powder are known to be having good electrical conductivity. Hence, this paper aims to investigate the effect of different graphite/chitosan ink ratio composition towards flexible and stretchable strain sensor performance. Three different graphite/chitosan ink ratios of 1:2, 1:3, and 1:4 were synthesized. The surface morphology shows that the graphite/chitosan ink ratio 1:2 has the most compact structure resulting to good adaptability, conductivity, and flexibility. The XRD and FTIR results illustrate that graphite are successfully synthesized with chitosan solution. Measurement result shows that the highest strain detection range is also attainable by graphite/chitosan ink ratio of 1:2 at 83.3% strain and gauge factor of 5.44. This concludes that graphite/chitosan ink ratio of 1:2 is the optimum ratio as highest stretchability and sensitivity are recorded. Therefore, it is important to have an adequate amount of chitosan solution to obtain good ink structure and great performance of strain sensor.

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## Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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## Acknowledgements

This work is fully supported by the Ministry of Higher Education (MOHE) Fundamental Research Grant Scheme (FRGS 21-249-0858) (Grant No: FRGS/1/2021/TKO/UIAM/02/14).

## Funding

This work is fully supported by the Ministry of Higher Education (MOHE) Fundamental Research Grant Scheme (FRGS 21-249-0858) (Grant No: FRGS/1/2021/TKO/UIAM/02/14).

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### Contributions

The authors confirm the contribution as follows: study and idea conception and design: AAMR Synthesis, characterization and measurements: NIIMH Analysis and interpretation of results AAMR, NIIMH, FBA, MAbMH Draft Manuscript preparation: NIIMH in consultation with AAMR, FBA and MAbMH. Supervised the findings of the project: AAMR All authors discussed the results and contributed to the final manuscript, reviewed the results and approved the final version of the manuscript. All authors whose names appear on the submission: made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work; drafted the work or revised it critically for important intellectual content; approved the version to be published; and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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### Ethics declarations

### Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Ethical approval

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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Maizal Hairi, N.I.I., Md Ralib, A.A., Ahmad, F.B. et al. Synthesis and characterization of different graphite/chitosan ink ratio composition towards flexible strain sensor performance. *J Mater Sci: Mater Electron* (2022). <https://doi.org/10.1007/s10854-022-08463-8>  
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Received	Accepted	Published
30 January 2022	21 May 2022	07 June 2022
DOI	<a href="https://doi.org/10.1007/s10854-022-08463-8">https://doi.org/10.1007/s10854-022-08463-8</a>	

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