**High-performance triboelectric nanogenerator based on ZrB2/** **polydimethylsiloxane for metal corrosion protection**

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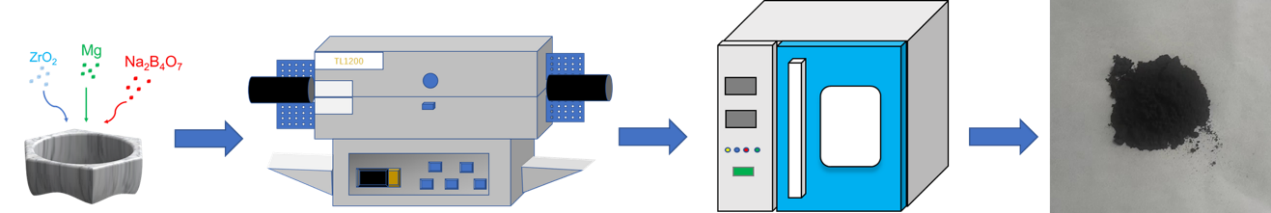
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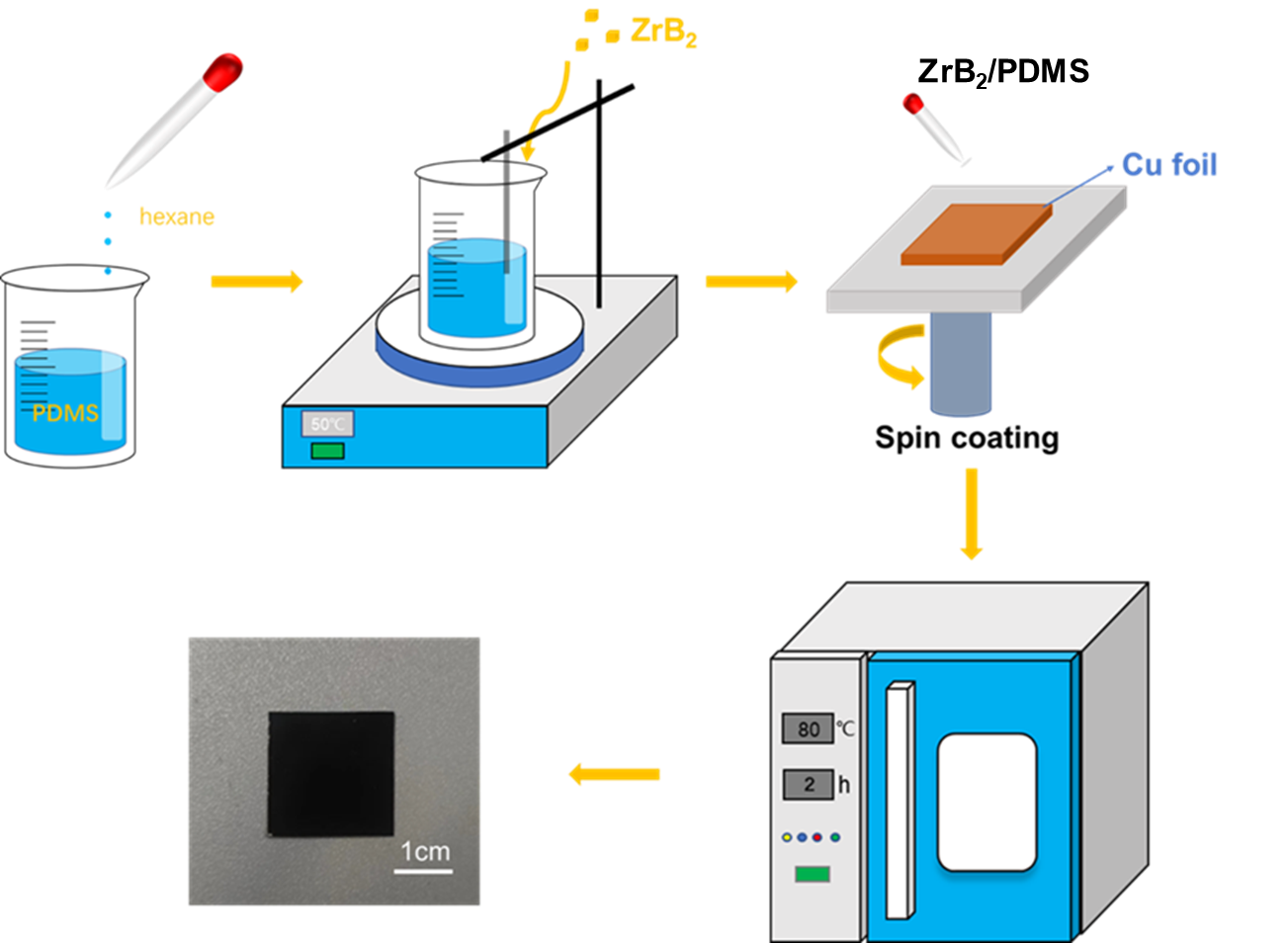
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**Fig. S1. Preparation process of ZrB2 nanoparticles.**

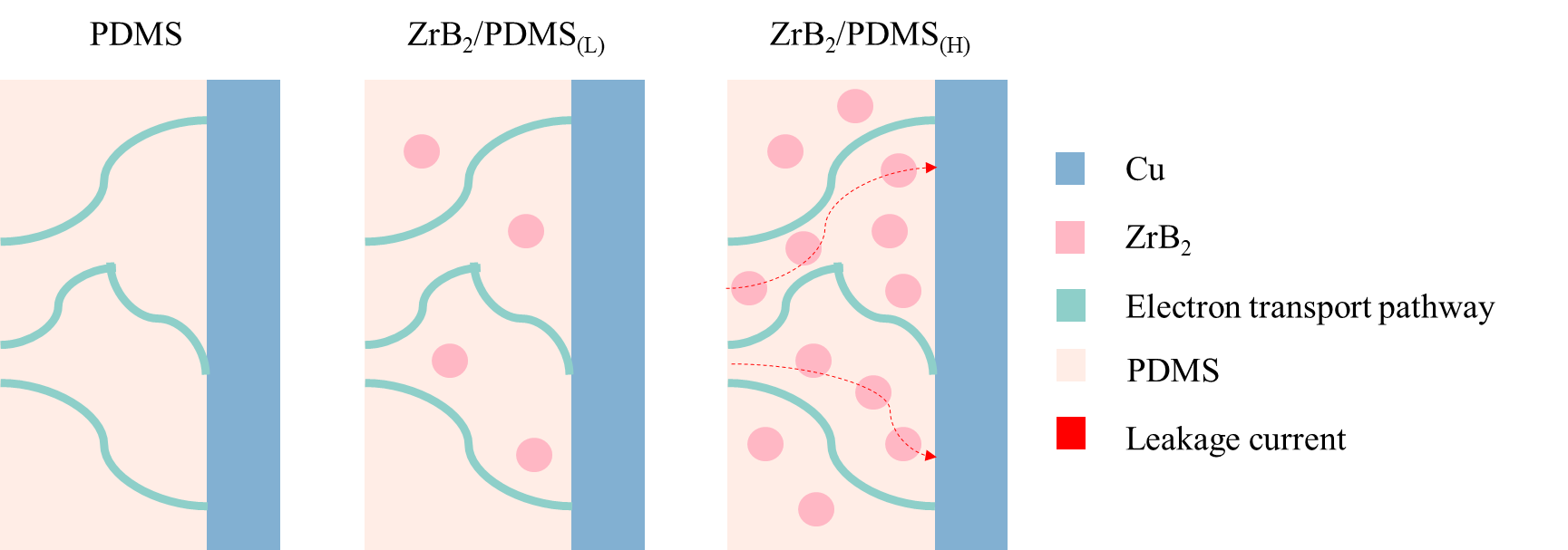


**Fig. S2. Preparation process of ZrB2/PDMS films.**

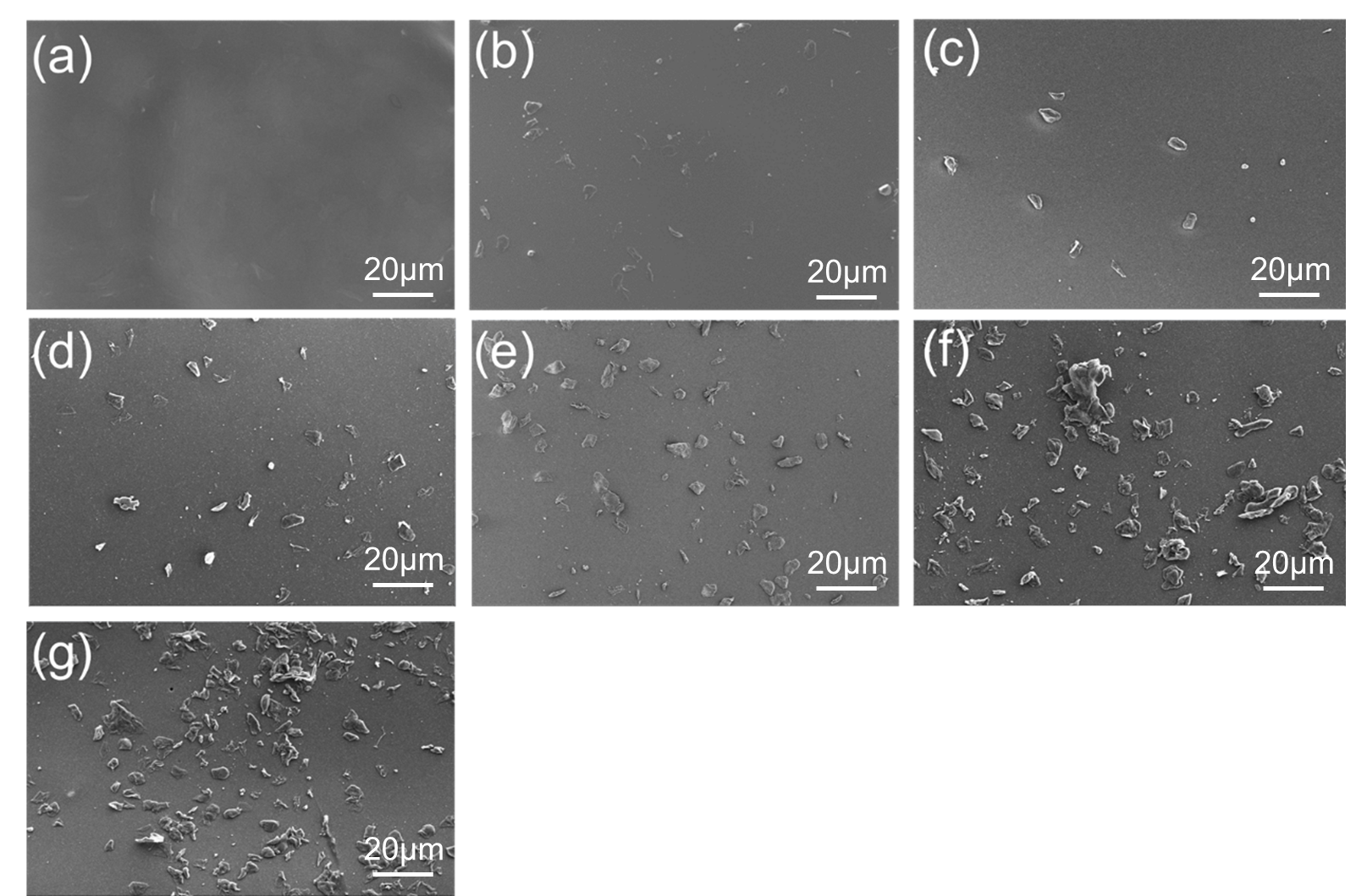
图表, 折线图

描述已自动生成

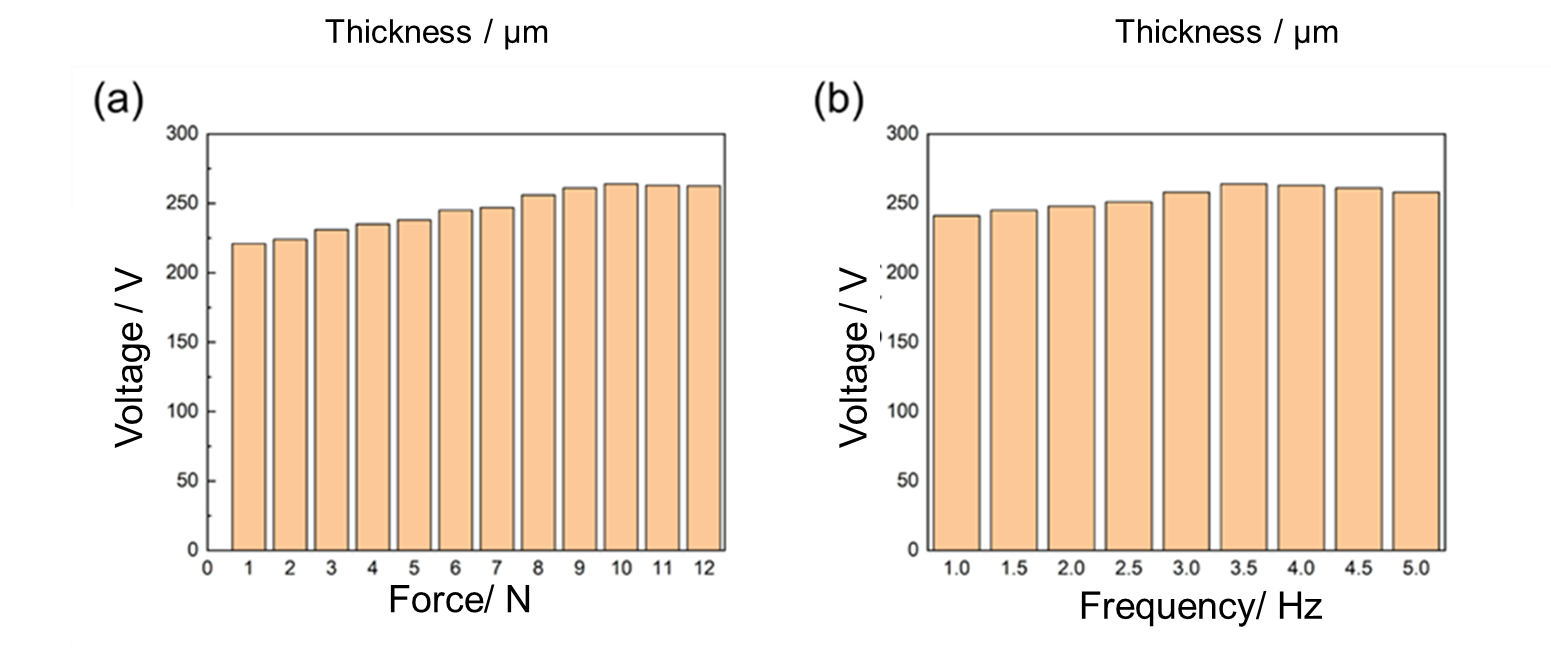
**Fig. S3. Dielectric constant of PDMS films at different concentrations.**



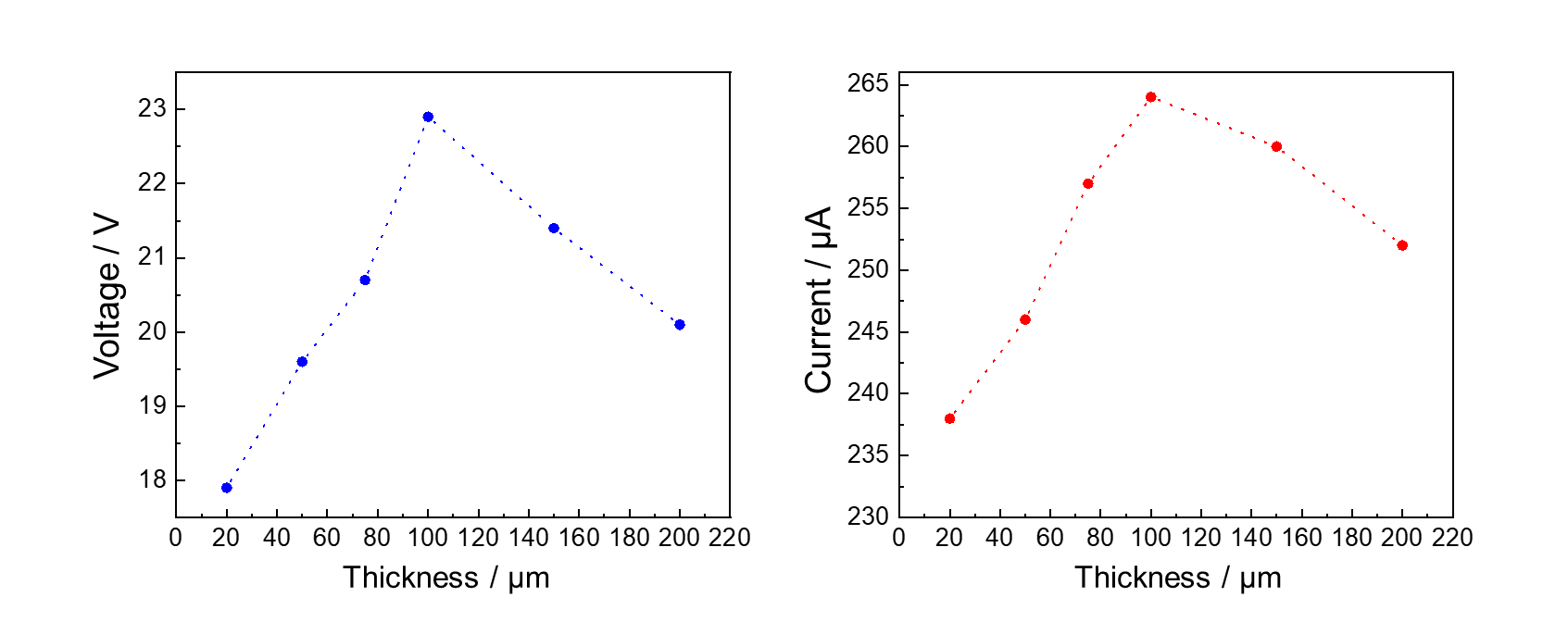
**Fig. S4. Modeling of electronic pathways in films of different concentrations.**



**Fig. S5. SEM images of different concentrations of ZrB2/PDMS thin films: (a) 0wt%; (b) 2wt%; (c)4wt%; (d)6wt%; (e) 8wt%; (f) 10wt%; (g) 12wt%.**



**Fig. S6. (a) Output various with force and voltage; (b) output various with frequency and voltage.**



**Fig. S7. ZrB2 films thickness as a function of (a) voltage and (b) current.**

**Table S1. Comparison of the output performance of TENGs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Positive triboelectric layer | Negative triboelectric layer | Voltage / V | Current / μA | Ref. |
| Al | PDMS/TiN | 51.8 | 36.8 | [1] |
| Al | PDMS/ZnFe2O4 | 60 | 7.4 | [2] |
| Chitosan/Albumin | PTFE | 77 | 13 | [3] |
| Al | PDMS/BT-MWCNT | 150 | 6.5 | [4] |
| PVA/Rice | FEP | 96 | 0.6 | [5] |
| Rice paper | PVC | 224 | 6 | [6] |
| Nylon | silica gel/Ag | 102.8 | 4.42 | [7] |
| Nylon-11 | PVC/KN | 208 | 24 | [8] |
| Al | PDMS/ ZrB2 | 264 | 22.9 | This work |

[1]Y. Xiao, X. Lv, L. Yang, M. Niu, and J. Liu, A High‐Performance Flexible Triboelectric Nanogenerator Based on Double‐Sided Patterned TiN/PDMS Composite Film for Human Energy Harvesting, Energy Technology, 9(2021), No.12, p.2100665.

[2] A. Nawaz, M.Kumar, N.Sarwar, D. i.Jeong, and D. H.Yoon, ZnFe2O4@PDMS composite film for mechanical energy harvesting and tactile sensing application. Materials Technology 37(2022), p.2659-2667.

[3]T. Charoonsuk, S. Pongampai, P. Pakawanit, and N. Vittayakorn, Achieving a highly efficient chitosan-based triboelectric nanogenerator via adding organic proteins: Influence of morphology and molecular structure, Nano Energy, 89(2021), p.106430.

[4]S. Feng, H. Zhang, D. He, Y. Xu, A. Zhang, Y. Liu, and J. Bai, Synergistic Effects of BaTiO3/Multiwall Carbon Nanotube as Fillers on the Electrical Performance of Triboelectric Nanogenerator Based on Polydimethylsiloxane Composite Films, Energy Technology, 7(2019), No. 6, p.1900101.

[5]A. P. Sathya Prasanna, V. Vivekananthan, G. Khandelwal, N. R. Alluri, N. P. Maria Joseph Raj, M. Anithkumar, and S.-J. Kim, Green Energy from Edible Materials: Triboelectrification-Enabled Sustainable Self-Powered Human Joint Movement Monitoring, ACS Sustainable Chemistry & Engineering, 10(2022), No. 20, p.6549.

[6]Y. Chi, K. Xia, Z. Zhu, J. Fu, H. Zhang, C. Du, and Z. Xu, Rice paper-based biodegradable triboelectric nanogenerator, Microelectronic Engineering, 216(2019), p.111059.

[7]P. Zhang, P. F. Li, H. H. Zhang, and L. Deng, Effect of Ag nanoparticle size on triboelectric nanogenerator for mechanical energy harvesting, Nanotechnology, 33(2022), No.47.

[8]H. Zhang, Y. Guo, J. Cui, J. Guo, G. Zhao, and B. Yang, Lead‐Free KNbO3 Nanoblocks Improved Triboelectric Nanogenerator with High Output Performance and Self‐Powered Anticorrosion System, ChemistrySelect, 6(2021), No.13, p.3169.