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The future of energy harvesting: A brief review of MXenes-based triboelectric nanogenerators
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Abstract
Triboelectric nanogenerators (TENGs) have shown immense potential as self-powering devices for energy harvesting, electronics, and self-powered sensing devices. However, the performance of TENGs largely depends on the materials used, therefore, it is crucial to select appropriate materials. While dielectric polymers, metals, and inorganic materials have been commonly employed as active materials for TENGs, there is a need to explore new materials that offer improved performance. One promising material is two-dimensional MXenes, which have shown exciting potential in various applications, including wearable sensors and electrochemical energy storage. For this reason, further research is needed to fully evaluate the performance of MXenes-based TENGs and to determine their suitability for practical applications. This review emphasizes the significance of material selection in order to optimize the performance of triboelectric nanogenerators (TENGs). Here, the mechanism of TENGs is clearly explained for devices that convert mechanical energy into electric energy. The concept of the triboelectric effect is also described, which generates charge density on material surfaces, along with various types of TENG working modes. The selection of materials is thoroughly discussed, highlighting the growing interest in polymeric and biopolymeric materials, as well as functionalized and inorganic triboelectric materials. Also, exploration of materials that can enhance the output of TENGs, such as chemical modification techniques and the utilization of 2D materials like graphene and MXenes to improve triboelectricity is also included. The synthesis methods and techniques for MXenes are explored in detail. Furthermore, the performance of MXenes-based TENGs for energy harvesting and self-powered sensing is evaluated, and their potential applications in wearable devices are assessed. The study concludes by providing recommendations for future research on MXenes-based TENGs and their applications in wearable devices. © 2023 John Wiley & Sons Ltd.

Author Keywords
2D materials; energy harvesting; MXenes; polymers; triboelectric nanogenerators; wearable devices

Index Keywords
Biopolymers, Chemical modification, Dielectric materials, Triboelectricity, Wearable technology; 2d material, Appropriate materials, Mxenes, Nanogenerators, Performance, Self-powered sensing, Self-powering, Sensing devices, Triboelectric nanogenerator, Wearable devices; Nanogenerators

References

- Wang, Z.L., Wu, W.Z.
(2012) *Angew Chem Int Ed*, 51.
Nanotechnology-enabled energy harvesting for self-powered micro-/nanosystems

- Fan, F.R., Tang, W., Wang, Z.L.
Flexible nanogenerators for energy harvesting and self-powered electronics
(2016) *Adv Mater*, 28, pp. 4283-4305.

- Xu, C., Wang, A.C., Zou, H.
Raising the working temperature of a triboelectric nanogenerator by quenching down electron thermionic emission in contact-electrification
(2018) *Adv Mater*, 30.

- Chen, B., Yang, Y., Wang, Z.L.
Scavenging wind energy by triboelectric nanogenerators
(2018) *Adv Energy Mater*, 8.

- Qian, J., Jing, X.
Wind-driven hybridized triboelectric-electromagnetic nanogenerator and solar cell

as a sustainable power unit for self-powered natural disaster monitoring sensor networks
(2018) *Nano Energy*, 52, pp. 78-87.

- Javadi, M., Heidari, A., Darbari, S.
Realization of enhanced sound-driven CNT-based triboelectric nanogenerator, utilizing sonic array configuration
(2018) *Curr Appl Phys*, 18, pp. 361-368.

- Cui, N., Gub, L., Liu, J.
High performance sound driven triboelectric nanogenerator for harvesting noise energy
(2015) *Nano Energy*, 15, pp. 321-328.

- Choi, J., Jung, I., Kang, C.Y.
A brief review of sound energy harvesting
(2019) *Nano Energy*, 56, pp. 169-183.

- Park, J.Y., Salauddin, M., Rasel, M.S.
Nanogenerator for scavenging low frequency vibrations
(2019) *J Micromech Microeng*, 29.

- Wu, C., Huang, H., Li, R., Fan, C.
Research on the potential of spherical triboelectric nanogenerator for collecting vibration energy and measuring vibration
(2020) *Sensors*, 20, p. 1063.

- Zhang, Q., Liang, Q., Liao, Q.
An amphiphobic hydraulic triboelectric nanogenerator for a self-cleaning and self-charging power system
(2018) *Adv Funct Mater*, 28.

- Wang, Z.L., Jiang, T., Xu, L.
Toward the blue energy dream by triboelectric nanogenerator networks
(2017) *Nano Energy*, 39, pp. 9-23.

- Wang, X., Wen, Z., Guo, H.
Fully packaged blue energy harvester by hybridizing a rolling triboelectric nanogenerator and an electromagnetic generator
(2016) *ACS Nano*, 10, pp. 11369-11376.

- Zhou, Y., Deng, W., Xu, J., Chen, J.
Engineering materials at the nanoscale for triboelectric nanogenerators
(2020) *Cell Rep Phys Sci*, 1.

- Jin, L., Xiao, X., Deng, W.
Manipulating relative permittivity for high-performance wearable triboelectric nanogenerators
(2020) *Nano Lett*, 20, pp. 6404-6411.

- Chen, G., Li, Y., Bick, M., Chen, J.
Smart textiles for electricity generation
(2020) *Chem Rev*, 120, pp. 3668-3720.

- Lin, Z.M., Yang, J., Li, X.S.
Large-scale and washable smart textiles based on triboelectric nanogenerator arrays for self-powered sleeping monitoring
(2017) *Adv Funct Mater*, 28.

- Wu, H., Haung, Y., Xu, F., Duan, Y., Yin, Z.
Energy harvesters for wearable and stretchable electronics: from flexibility to

stretchability
(2016) *Adv Mater*, 28, pp. 9881-9919.

- Yetisen, A.K., Qu, H., Manbachi, A.
Nanotechnology in textiles
(2016) *ACS Nano*, 10, pp. 3042-3068.

- Almuslem, A.S., Shaikh, S.F., Hussain, M.M.
Flexible and stretchable electronics for harsh-environmental applications
(2019) *Adv Mater Technol*, 4.

- Xie, L., Chen, X., Wen, Z.
Spiral steel wire based fiber-shaped stretchable and tailorable triboelectric nanogenerator for wearable power source and active gesture sensor
(2019) *Nano-Micro Lett*, 11, p. 39.

- Yin, Y., Wang, J., Zhao, S.
Stretchable and tailorable triboelectric nanogenerator constructed by nanofibrous membrane for energy harvesting and self-powered biomechanical monitoring
(2018) *Adv Mater Technol*, 3.

- Zhang, X.-S., Han, M., Kim, B., Bao, J.F., Brugger, J., Zhang, H.
All-in-one self-powered flexible microsystems based on triboelectric nanogenerators
(2018) *Nano Energy*, 47, pp. 410-426.

- Mohammadpour, R.
(2018) *Adv Eng Mater*, 20, p. 2018.
Flexible triboelectric nanogenerator based on high surface area TiO, Nanotube arrays

- Sun, J.G., Yang, T.N., Wang, C.Y., Chen, L.J.
A flexible transparent one-structure tribo-piezo-pyroelectric hybrid energy generator based on bio-inspired silver nanowires network for biomechanical energy harvesting and physiological monitoring
(2018) *Nano Energy*, 48, pp. 383-390.

- Niu, H., Du, X., Zhao, S.
Polymer nanocomposite-enabled high-performance triboelectric nanogenerator with self-healing capability
(2018) *RSC Adv*, 8, pp. 30661-30668.

- Lee, J.H., Hinchet, R., Kim, S.K., Kim, S., Kim, S.
(2015) *Energy Environ Sci*, 8, pp. 3605-3613.
Shape memory polymer-based self-healing triboelectric nanogenerator

- Jao, Y.T., Yang, P.K., Chiu, C.M.
A textile-based triboelectric nanogenerator with humidity-resistant output characteristic and its applications in self-powered healthcare sensors
(2018) *Nano Energy*, 50, pp. 513-520.

- Mule, A.R., Dudem, B., Graham, S.A., Yu, J.S.
Humidity sustained wearable pouch-type triboelectric nanogenerator for harvesting mechanical energy from human activities
(2019) *Adv Funct Mater*, 29.

- Huang, T., Zhang, J., Yu, B.
Fabric texture design for boosting the performance of a knitted washable textile triboelectric nanogenerator as wearable power
(2019) *Nano Energy*, 58, pp. 375-383.

- Ning, C., Tian, L., Zhao, X.
Washable textile-structured single-electrode triboelectric nanogenerator for self-powered wearable electronics
(2018) *J Mater Chem A*, 6, pp. 19143-19150.

- Dong, K., Wang, Y.-C., Deng, J.
A highly stretchable and washable all-yarn-based self-charging knitting power textile composed of fiber triboelectric nanogenerators and supercapacitors
(2017) *ACS Nano*, 11, pp. 9490-9499.

- Guo, H., Yeh, M.-H., Lai, Y.-C.
All-in-one shape-adaptive self-charging power package for wearable electronics
(2016) *ACS Nano*, 10, pp. 10580-10588.

- Chen, Y., Pu, X., Liu, M.
Shape-adaptive, self-healable triboelectric nanogenerator with enhanced performances by soft solid–solid contact electrification
(2019) *ACS Nano*, 13, pp. 8936-8945.

- Zhu, G., Zhou, Y.S., Bai, P.
A shape-adaptive thin-film-based approach for 50% high-efficiency energy generation through micro-grating sliding electrification
(2014) *Adv Mater*, 26, pp. 3788-3796.

- Wang, C., Wu, C., Pisignano, D., Wang, Z.L., Persano, L.
Polymer nanogenerators: Opportunities and challenges for large-scale applications
(2018) *J Appl Polym Sci*, 135.

- Xu, C., Zi, Y., Wang, A.C.
On the electron-transfer mechanism in the contact-electrification effect
(2018) *Adv Mater*, 30.

- Tang, X., Guo, X., Wu, W., Wang, G.
2D metal carbides and nitrides (MXenes) as high-performance electrode materials for lithium-based batteries
(2018) *Adv Energy Mater*, 8.

- Urbankowski, P., Anasori, B., Hantanasirisakul, K.
2D molybdenum and vanadium nitrides synthesized by ammoniation of 2D transition metal carbides (MXenes)
(2017) *Nanoscale*, 9, pp. 17722-17730.

- Pang, J., Mendes, R.G., Bachmatiuk, A.
Applications of 2D MXenes in energy conversion and storage systems
(2019) *Chem Soc Rev*, 48, pp. 72-133.

- Sang, X., Xie, Y., Lin, M.-W.
Atomic defects in monolayer titanium carbide (Ti₃C₂Tx) MXene
(2016) *ACS Nano*, 10, pp. 9193-9200.

- Wang, X., Shen, X., Gao, Y., Wang, Z., Yu, R., Chen, L.
Atomic-scale recognition of surface structure and intercalation mechanism of Ti3C2X
(2015) *J Am Chem Soc*, 137, pp. 2715-2721.

- Hart, J.L., Hantanasirisakul, K., Lang, A.C.
Control of MXenes' electronic properties through termination and intercalation
(2019) *Nat Commun*, 10, p. 522.

- Ivanovskii, A.L., Enyashin, A.N.
Graphene-like transition-metal nanocarbides and nanonitrides
(2013) *Russ Chem Rev*, 82, pp. 735-746.

- Jiang, Q., Kurra, N., Alhabeb, M., Gogotsi, Y., Alshareef, H.N.
All pseudocapacitive MXene-RuO₂ asymmetric supercapacitors
(2018) *Adv Energy Mater*, 8.

- Dong, Y., Mallineni, S.S.K., Maleski, K.
Metallic MXenes: a new family of materials for flexible triboelectric nanogenerators
(2018) *Nano Energy*, 44, pp. 103-110.

- Fan, F.R., Tian, Z.Q., Lin Wang, Z.
Flexible triboelectric generator
(2012) *Nano Energy*, 1, pp. 328-334.

- Maxwell, J.C.
(1873) *A treatise on electricity and Magnetism*, pp. 30-33.
Oxford the clarendon Press

- Wang, Z.L.
On Maxwell's displacement current for energy and sensors: the origin of nanogenerators
(2017) *Mater Today*, 20, pp. 74-82.

- Wang, Z.L., Lin, L., Chen, J., Niu, S., Zi, Y.
(2016) *Triboelectric Nanogenerators*, p. 47.
Springer

- Wang, Z.L., Lin, L., Chen, J., Niu, S., Zi, Y.
Triboelectric nanogenerator: lateral sliding mode
(2016) *Triboelectric Nanogenerators*, p. 49.
Springer

- Wang, Z.L., Lin, L., Chen, J., Niu, S., Zi, Y.
Triboelectric nanogenerator: single-electrode mode
(2016) *Triboelectric Nanogenerators*, p. 91.
Springer

- Wang, Z.L., Lin, L., Chen, J., Niu, S., Zi, Y.
Triboelectric nanogenerator: freestanding triboelectric-layer mode
(2016) *Triboelectric Nanogenerators*, p. 109.
Springer

- Chandrasekhar, A., Alluri, N.R., Saravanakumar, B., Selvarajan, S., Kim, S.J.A.
A microcrystalline cellulose ingrained polydimethylsiloxane triboelectric nanogenerator as a self-powered locomotion detector
(1810) *J Mater Chem C*, 2017, pp. 5-1815.

- Feng, H., Zhao, C., Tan, P., Liu, R., Chen, X., Li, Z.
Nanogenerator for biomedical applications
(2018) *Adv Healthc Mater*, 7.

- Yi, F., Zhang, Z., Kang, Z., Liao, Q., Zhang, Y.
Recent advances in triboelectric nanogenerator-based health monitoring
(2019) *Adv Funct Mater*, 29.

- Zou, H., Zhang, Y., Guo, L.
Quantifying the triboelectric series
(2019) *Nat Commun*, 10, p. 1427.

- Seol, M., Kim, S., Cho, Y.
Triboelectric series of 2D layered materials
(2018) *Adv Mater*, 30.

- Shin, S.-H., Bae, Y.E., Moon, H.K.
Formation of triboelectric series via atomic-level surface functionalization for triboelectric energy harvesting
(2017) *ACS Nano*, 11, pp. 6131-6138.

- Zenkiewicz, M., Zuk, T., Markiewicz, E.
Triboelectric series and electrostatic separation of some biopolymers
(2015) *Polym Test*, 42, pp. 192-198.

- Zou, Y., Libanori, A., Xu, J., Nashalian, A., Chen, J.
Triboelectric nanogenerator enabled smart shoes for wearable electricity generation
(2020) *AAAS Res*, p. 1.

- Zhang, R., Olin, H.
Material choices for triboelectric nanogenerators: a critical review
(2020) *EcoMat*, 2.

- Qian, C., Li, L., Gao, M.
All-printed 3D hierarchically structured cellulose aerogel based triboelectric nanogenerator for multi-functional sensors
(2019) *Nano Energy*, 63.

- Yao, C., Hernandez, A., Yu, Y., Cai, Z., Wang, X.
Triboelectric nanogenerators and power-boards from cellulose nanofibrils and recycled materials
(2016) *Nano Energy*, 30, pp. 103-108.

- Yao, C., Yin, X., Yu, Y., Cai, Z., Wang, X.
Chemically functionalized natural cellulose materials for effective triboelectric nanogenerator development
(2017) *Adv Funct Mater*, 27.

- Chen, J., Wang, Z.L.
Reviving vibration energy harvesting and self-powered sensing by a triboelectric nanogenerator
(2017) *Dent J*, 1, pp. 480-521.

- Kim, S., Gupta, M.K., Lee, K.Y.
Transparent flexible graphene triboelectric nanogenerators
(2014) *Adv Mater*, 26, pp. 3918-3925.

- Naguib, M., Kurtoglu, M., Presser, V.
Two-dimensional nanocrystals produced by exfoliation of Ti₃AlC₂
(2011) *Adv Mater*, 23, pp. 4248-4253.

- Naguib, M., Gogotsi, Y.
Synthesis of two-dimensional materials by selective extraction
(2015) *Acc Chem Res*, 48, pp. 128-135.

- Anasori, B., Lukatskaya, M.R., Gogotsi, Y.
2D metal carbides and nitrides (MXenes) for energy storage
(2017) *Nat Rev Mater*, 2.

- Dillon, A.D., Ghidiu, M.J., Krick, A.L.
Highly conductive optical quality solution-processed films of 2D titanium carbide
(2016) *Adv Funct Mater*, 26, pp. 4162-4168.

- Ren, C.E., Hatzell, K.B., Alhabeb, M., Ling, Z., Mahmoud, K.A., Gogotsi, Y.
Charge- and size-selective ion sieving through Ti₃C₂Tx MXene membranes
(2015) *J Phys Chem Lett*, 6, pp. 4026-4031.

- Lukatskaya, M.R., Mashtalir, O., Ren, C.E.
Cation intercalation and high volumetric capacitance of two-dimensional titanium carbide
(2013) *Science*, 341, pp. 1502-1505.

- Ghidiu, M., Lukatskaya, M.R., Zhao, M.Q., Gogotsi, Y., Barsoum, M.W.
Conductive two-dimensional titanium carbide 'clay' with high volumetric capacitance
(2014) *Nature*, 516, pp. 78-81.

- Wang, X., Kajiyama, S., Iinuma, H.
Pseudocapacitance of MXene nanosheets for high-power sodium-ion hybrid capacitors
(2015) *Nat Commun*, 6, p. 6544.

- Liang, X., Garsuch, A., Nazar, L.F.
Sulfur cathodes based on conductive MXene nanosheets for high-performance lithium–sulfur batteries
(2015) *Angew Chem Int Ed*, 54, p. 3907.

- Seh, Z.W., Fredrickson, K.D., Anasori, B.
Two-dimensional molybdenum carbide (MXene) as an efficient electrocatalyst for hydrogen evolution
(2016) *ACS Energy Lett*, 1, pp. 589-594.

- Hantanasirisakul, K., Zhao, M.Q., Urbankowski, P.
Fabrication of Ti₃C₂Tx MXene transparent thin films with tunable optoelectronic properties
(2016) *Adv Electron Mater*, 2.

- Halim, J., Lukatskaya, M.R., Cook, K.M.
Transparent conductive two-dimensional titanium carbide epitaxial thin films
(2014) *Chem Mater*, 26, pp. 2374-2381.

- Shahzad, F., Alhabeb, M., Hatter, C.B.
Electromagnetic interference shielding with 2D transition metal carbides (MXenes)
(2016) *Science*, 353, pp. 1137-1140.

- Naguib, M., Mochalin, V.N., Barsoum, M.W., Gogotsi, Y.
25th anniversary article: MXenes: a new family of two-dimensional materials
(2014) *Adv Mater*, 26, pp. 992-1005.

- Naguib, M., Mashtalir, O., Carle, J.
Two-dimensional transition metal carbides
(2012) *ACS Nano*, 6, pp. 1322-1331.

- Ghidiu, M., Halim, J., Kota, S., Bish, D., Gogotsi, Y., Barsoum, M.W.
Ion-exchange and cation solvation reactions in Ti₃C₂ MXene
(2016) *Chem Mater*, 28, pp. 3507-3514.

- Kumar, S., Rehman, M.A., Lee, S.
Supercapacitors based on Ti₃C₂Tx MXene extracted from supernatant and current collectors passivated by CVD-graphene
(2021) *Sci Rep*, 11, p. 649.

- Halim, J., Kota, S., Lukatskaya, M.R.
Synthesis and characterization of 2D molybdenum carbide (MXene)
(2016) *Adv Funct Mater*, 26, pp. 3118-3127.

- Umrao, S., Tabassian, R., Kim, J.
MXene artificial muscles based on ionically cross-linked Ti₃C₂ Tx electrode for kinetic soft robotics
(2019) *Sci Robot*, 4.

- Ren, C.E., Zhao, M.-Q., Makaryan, T.
Porous two-dimensional transition metal carbide (MXene) flakes for high-performance Li-Ion storage
(2016) *ChemElectroChem*, 3, pp. 689-693.

- Lipatov, A., Alhabeb, M., Lukatskaya, M.R., Boson, A., Gogotsi, Y., Sinitskii, A.
Effect of synthesis on quality, electronic properties and environmental stability of individual monolayer Ti₃C₂ MXene flakes
(2016) *Adv Electron Mater*, 2.

- Li, M., Lu, J., Luo, K.
Element replacement approach by reaction with Lewis acidic molten salts to synthesize nanolaminated MAX phases and MXenes
(2019) *J Am Chem Soc*, 141, pp. 4730-4737.

- Cao, W.T., Ouyang, H., Xin, W.
A stretchable highoutput triboelectric nanogenerator improved by mxene liquid electrode with high electronegativity
(2020) *Adv Funct Mater*, 30.

- Yang, W., Chen, H., Wu, M.
A flexible triboelectric nanogenerator based on cellulose-reinforced MXene composite film
(2022) *Adv Mater Interfaces*, 9.

- He, W., Sohn, M., Ma, R., Kang, D.J.
Flexible single-electrode triboelectric nanogenerators with MXene/PDMS composite film for biomechanical motion sensors
(2020) *Nano Energy*, 78.

- Liu, Y., Li, E., Yan, Y.
A one-structure-layer PDMS/Mxenes based stretchable triboelectric nanogenerator for simultaneously harvesting mechanical and light energy
(2021) *Nano Energy*, 86.

- Jiang, C., Wu, C., Li, X.
All-electrospun flexible triboelectric nanogenerator based on metallic MXene nanosheets
(2019) *Nano Energy*, 59, pp. 268-276.

- Deka, B.K., Hazarika, A., Kwak, M.J.
Triboelectric nanogenerator-integrated structural supercapacitor with in situ MXene-dispersed N-doped Zn–Cu selenide nanostructured woven carbon fiber for energy harvesting and storage
(2021) *Energy Storage Mater*, 43, pp. 402-410.

- Wang, D., Lin, Y., Hu, D., Jiang, P., Huang, X.
Multifunctional 3D-MXene/PDMS nanocomposites for electrical, thermal and triboelectric applications
(2020) *Compos Part A*, 130.

- Sohel Rana, S.M., Toyabur Rahman, M., Salauddin, M.
Electrospun PVDF-TrFE/MXene nanofiber mat-based triboelectric nanogenerator for smart home appliances
(2021) *J ACS Appl Mater Interfaces*, 13, pp. 4955-4967.

- Zhang, Z., Yan, Q., Liu, Z.
Flexible MXene composed triboelectric nanogenerator via facile vacuum-assistant filtration method for self-powered biomechanical sensing
(2021) *Nano Energy*, 88.

- Fan, J., Yuan, M., Wang, L., Xia, Q., Zheng, H., Zhou, A.
MXene supported by cotton fabric as electrode layer of triboelectric nanogenerators for flexible sensors
(2023) *Nano Energy*, 105.

- Wang, D., Zhang, D., Yang, Y., Mi, Q., Zhang, J., Yu, L.
Multifunctional Latex/polytetrafluoroethylene-based triboelectric nanogenerator for self-powered organ-like MXene/metal–organic framework-derived CuO nanohybrid ammonia sensor
(2021) *ACS Nano*, 15, pp. 2911-2919.

- Zhang, S., Rana, S.M.S., Bhatta, T.
3D printed smart glove with pyramidal MXene/Ecoflex composite-based toroidal triboelectric nanogenerators for wearable human-machine interaction applications
(2023) *Nano Energy*, 106.

- Cheng, Y., Zhu, W., Lu, X., Wang, C.
Lightweight and flexible MXene/carboxymethyl cellulose aerogel for electromagnetic shielding, energy harvest and self-powered sensing
(2022) *Nano Energy*, 98.

- Rana, S.M.S., Rahman, M.T., Zahed, M.A.
Zirconium metal-organic framework and hybridized Co-NPC@MXene nanocomposite-coated fabric for stretchable, humidity-resistant triboelectric nanogenerators and self-powered tactile sensors
(2022) *Nano Energy*, 104.

- Yi, Q., Pei, X., Das, P., Qin, H., Lee, S.W., Esfandyarpour, R.
A self-powered triboelectric MXene-based 3D-printed wearable physiological biosignal sensing system for on-demand, wireless, and real-time health monitoring
(2022) *Nano Energy*, 101.

- Zhang, H., Zhang, D., Wang, Z.
Ultrastretchable, self-healing conductive hydrogel-based triboelectric nanogenerators for human–computer interaction
(2023) *ACS Appl Mater Interfaces*, 15, pp. 5128-5138.

- Qin, P.
Stretchable and self-healable conductive hydrogel-based multifunctional triboelectric nanogenerator for energy harvesting and dance motion sensing
(2023) *APL Mater*, 11.

- Hao, Y., Zhang, Y., Mensah, A., Liao, S., Lv, P., Wei, Q.
Scalable, ultra-high stretchable and conductive fiber triboelectric nanogenerator for biomechanical sensing
(2023) *Nano Energy*, 109.

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