# Current collector-free printed three-dimensional MXene-based anodes for lithium-ion batteries

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Lithium-ion batteries have risen to prominence as a cutting-edge and highly effective solution for energy storage systems. İt has attracted widespread applications spanning through various industries including; consumer electronics, electric transportation, biomedical devices, and renewable energy infrastructure. İn search to improve energy storagy systems, many researchers have turned to Mxenes as a highly promising option for anode materials. Mxenes which is optimized from MAXphase ($Ti_3AlC_2$) as shown in Fig.1 below belongs to a group of two-dimensional transition metal carbides and nitrides, have captured considerable interest due to their outstanding electrochemical properties and distinctive structural features.

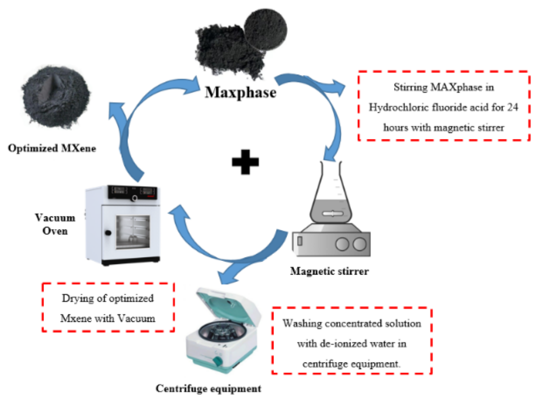


**Figure 1.** Optimization process of MAXphase to MXene.

As a printable anode material, the process was simple and scalable, which was achieved through 3D printing technique as shown in fig. 2 above.

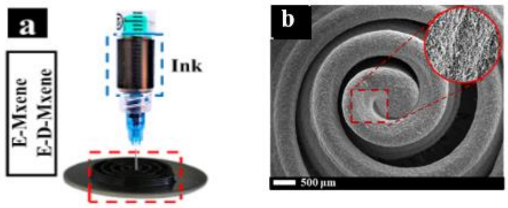


**Figure 2.** Illustration of 3D MXene ink printed electrodes with different layers

Technical characterization and electrochemical performance of the 3D MXene-based anodes was carefully analyzed including SEM, XRD, capacity, cycling stability, and rate capability, a specific capacity of 120 $mAhg^{-1}$ with almost 99.99% columbic efficiency after 100 cycles were obtained indicating that this approach has potentials to produce high performance batteries for the development and manufacturing of advanced next generation energy storage devices.

This paper aimed to reveal the dual functional properties of MXene as an active and conductive material for the development of lithium-ion batteries eliminating the need for additional current collector. Cost and weight reduction are the two advantages that this novel approach has promised during battery manufacturing.

## Reference

[1] https://doi.org/10.3390/recycling8030048.

Emmanuel Chisom Nwaogu is a citizen of Nigeria who obtained his bachelors degree at Michael Okpara University of Agriculture Nigeria in Chemical Engineering. Currently, he has completed his Master's degree in Chemical and Materials Engineering at Nazarbayev University, Kazakhstan. His research interest focuses in the dormain of Energy storage systems, with a specific empasis on lithium-ion batteries, battery material Characterization and development of high-capacity electrodes for lithium-ion batteries via 3D-printng technology.

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