IOCEN 2026 Conference

The 3rd International Online Conference on Energies

12–15 May 2026 | Online

MDPI

High-Performance Thermoelectric MXene/SWCNT Composites

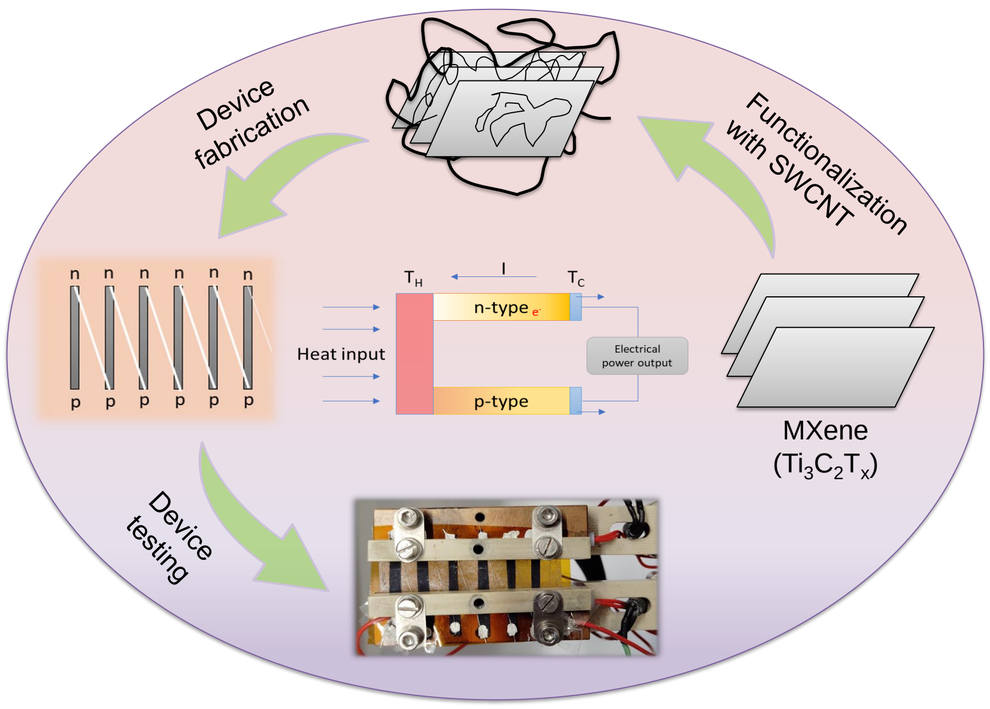
भारतीय प्रौद्योगिकी संस्थान जम्मू
INDIAN INSTITUTE OF TECHNOLOGY JAMMU
विद्याधनं सर्वधन प्रधानम्

Priyam Srivastava*[a,b], Rani Rohini[a], Beate Krause[b]
[a]Indian Institute of Technology Jammu
[b]Leibniz Institute of Polymer Research Dresden

ipf Leibniz-Institut für Polymerforschung Dresden

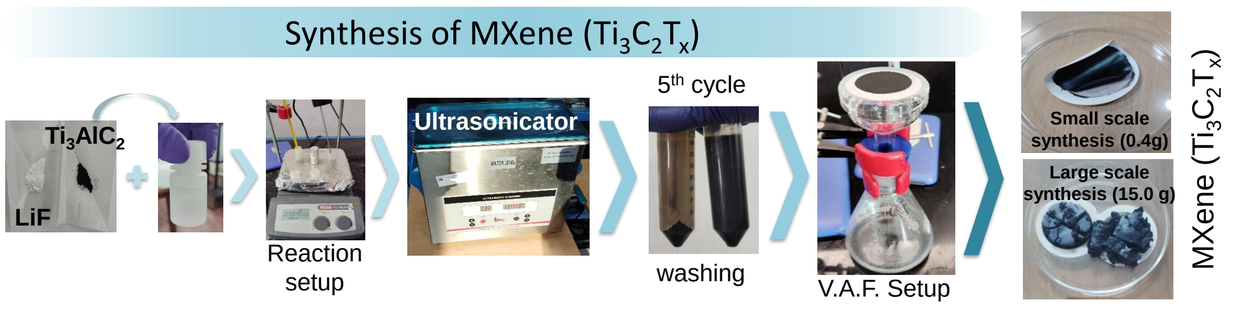
INTRODUCTION & AIM

- Synthesis of MXene ($Ti_3C_2T_x$) using modified MILD method.
- Analyzing the role of temperature and ultrasonication during synthesis.
- Functionalization of MXene with SWCNT.
- Study of thermoelectric properties of MXene/SWCNT buckypaper.

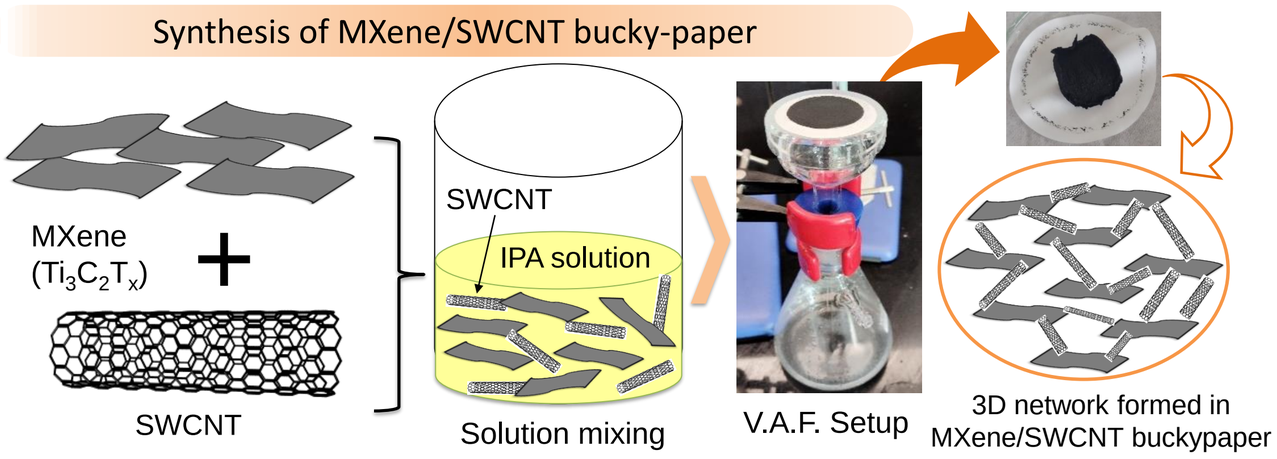


METHOD

Synthesis of MXene ($Ti_3C_2T_x$)



Synthesis of MXene/SWCNT bucky-paper



CONCLUSION

- Effective etching and well exfoliated MXene was synthesized by modified MILD method.
- Antagonistic effect was observed in thermal conductivity for MXene-SWCNT buckypaper
- M90C10 sample showed almost equal TE properties with less amount of SWCNT.
- TE module was fabricated with M90C10 buckypaper which generated output power of 0.22 µW, voltage of 16 mV and Seebeck coefficient of ~333 µV/K at $\Delta T = 48K$.

REFERENCES

Conflict of Interest

The authors declare no conflicts of interest.

Acknowledgements

We are thankful to Saptrishi facility in IIT Jammu and IPF Dresden to provide high-end instruments for testing and characterization. We are also thankful to Dr. Marén Gültner, lab staff, and lab technicians of IPF Dresden for their support during the experiments.

References

1) Priyam Srivastava and Rani Rohini, In Situ Characterization of Temperature-Dependent Thermal Conductivity in MXene ($Ti_3C_2T_x$) Using Raman Spectroscopy, the Journal of Physical Chemistry C 2026 130 (8), 3016-3021.

RESULTS & DISCUSSION

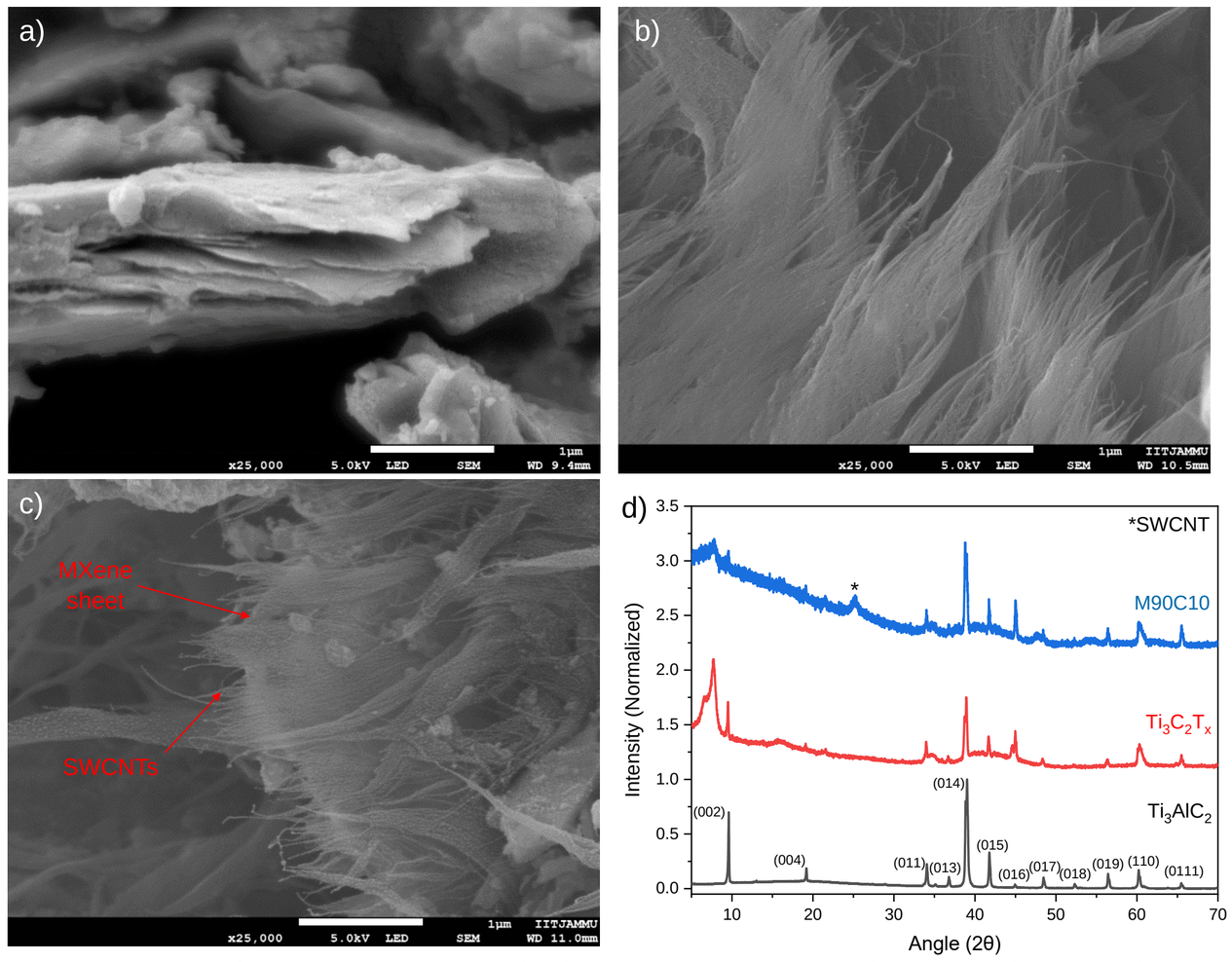


Figure 1 FESEM of a) MXene, b) SWCNT (buckypaper), c) M90C10, & d) Correspoding XRD data.

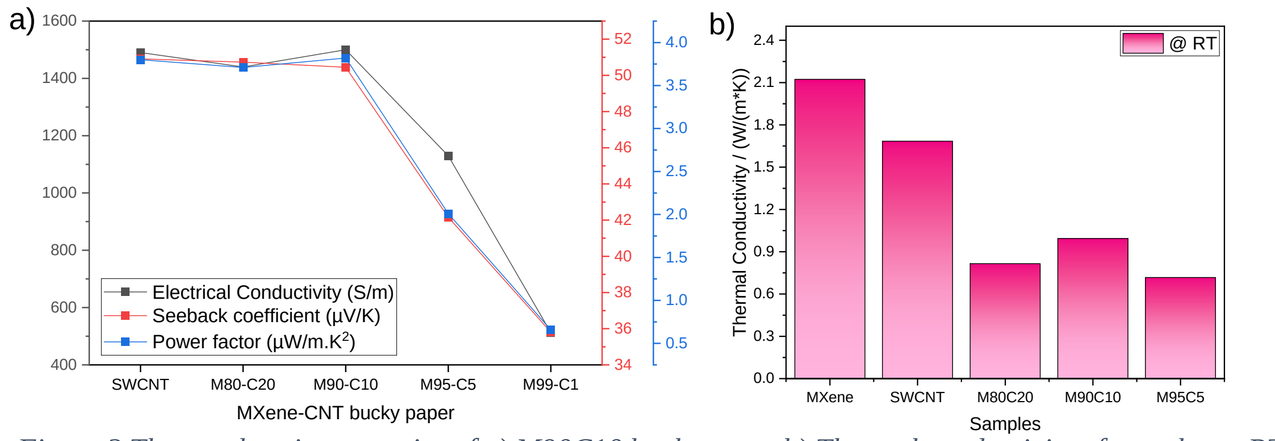


Figure 2 Thermoelectric properties of a) M90C10 buckypaper, b) Thermal conductivity of samples at RT.

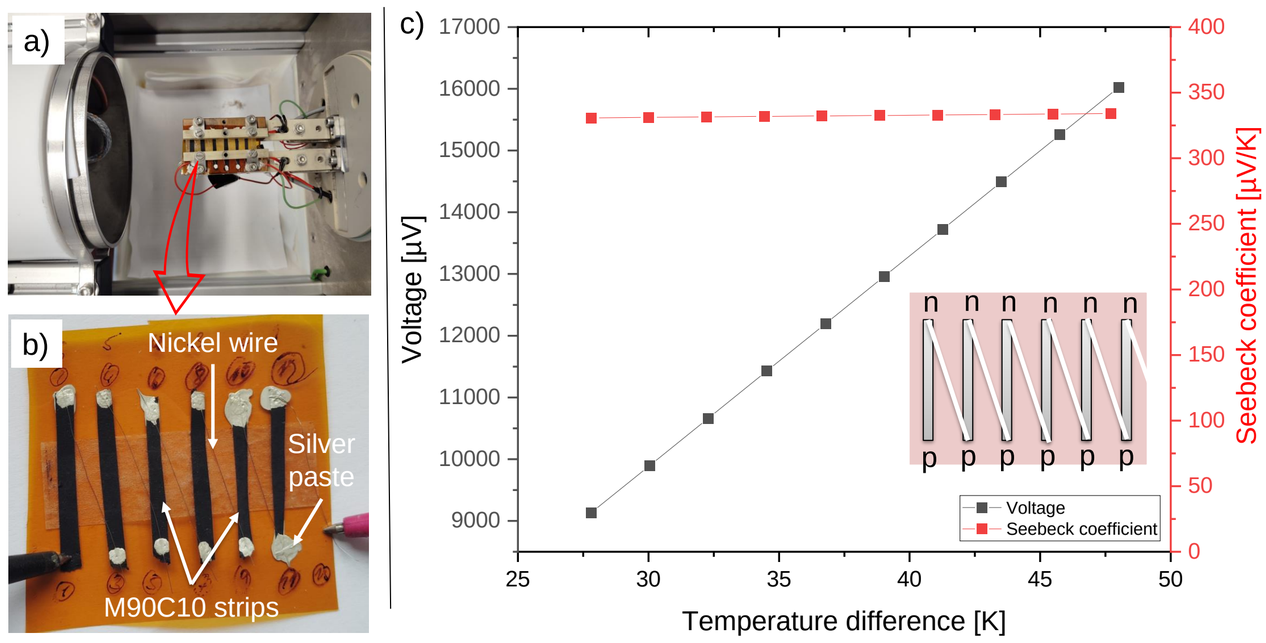


Figure 3 Thermoelectric module testing of M90C10 sample, a) Thermoelectric measurement setup at IPF [one electrode was held constant at ~32 °C and other electode was heated upto ~82 °C], b) TE Module of M90C10, c) Generated voltage and Seebeck coefficient (~333 µV/K) with respect to temperature difference whereas incet is showing the schematic of TE module.