



# AVVISO DI SEMINARIO

Il giorno 15/09/2023 alle ore 14:30  
nell'aula Seminari

Il Prof. ***PAOLO MELE***

Shibaura Institute of Technology di Tokio

terrà un seminario dal titolo

**“Thermoelectric modules based on thin films for IoT applications”**

Proponente: Prof.ssa Barbara Mecheri

# Thermoelectric modules based on thin films for IoT applications

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Compact, light thermoelectric modules based on thin film legs were prepared using different materials and techniques: (a) five ink-jet printed Ag electrode-legs alternated with five screen-printed *p*-type PEDOT:PSS legs on photo-paper scaffold [1]; (b) five *n*-type and five *p*-type skutterudite legs of the composition  $\text{Sm}_y(\text{Fe}_x\text{Ni}_{1-x})_4\text{Sb}_{12}$  (*n*-type:  $x = 0.63$  and  $y = 0.20$ ; *p*-type:  $x = 0.70$  and  $y = 0.40$ ) [2, 3] deposited on silica substrate by pulsed laser deposition (PLD); (c) 5 Al-doped ZnO (*n*-type) legs alternated with 5  $\text{Ca}_3\text{Co}_4\text{O}_9$  (*p*-type) legs deposited on  $\text{Al}_2\text{O}_3$  and silica substrates by PLD [4].

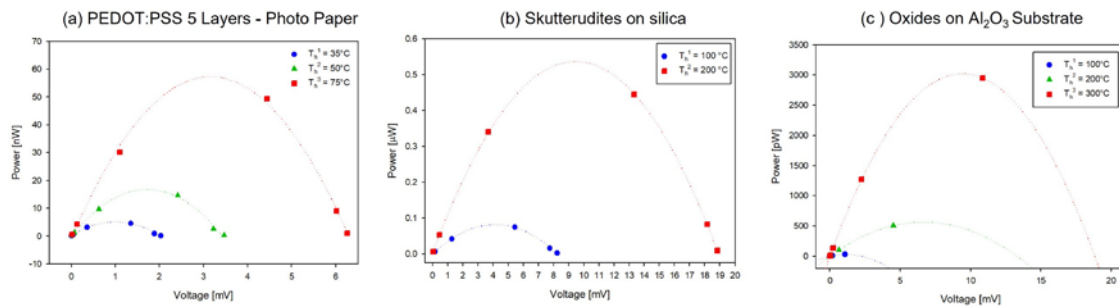


Fig. 1: Output power/voltage curves for: (a) PEDOT:PSS/Ag module; (b) skutterudites-based module and (c) oxides-based module

The power output of the modules was measured with a custom-made apparatus. As displayed in Fig. 1, the maximum output power of the modules was measured as 60 nW ( $T = 75^\circ\text{C}$ ) for the PEDOT:PSS/Ag module on photo-paper; 0.53  $\mu\text{W}$  ( $T = 300^\circ\text{C}$ ) for the skutterudite-based module; 3 nW ( $T = 300^\circ\text{C}$ ) for the oxide-based module.

These encouraging results suggest the feasibility of miniaturized thermoelectric modules for powering out-of-the-grid IoT devices.

## References

- [1] H. Shigemune et al., *IEEE Robotics and Automation Letters* 2 (2), **2017**, 1001-1007.
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- [4] S. Saini et al., *Energy Convers. Manag.* 114, **2016**, 251-257.

## Acknowledgements

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