# Graphene and other 2d crystals for energy devices

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Energy conversion and storage are two of the grand challenges that our society is facing. New materials and processes [1] can improve the performance of existing devices or enable new ones that are also environmentally benign. In this talk we will start by reviewing recent progress on the application of graphene, related two-dimensional crystals, and hybrid systems for energy conversion and storage [2]. The versatility of graphene and related materials can lead to new power management solutions for portable and flexible devices, as well as integration in living environments. We will then focus on our recent developments of graphene-based ink battery that displays an estimated energy density of about 200 $Whkg^{-1}$ and a stable operation for over 80 charge-discharge cycles [3]. These properties are linked to the graphene nanoflake anode displaying crystalline order and high uptake of lithium at the edges. We also discuss the role of the graphene nanoflake morphology on the mechanism of lithium uptake highlighting the impact of the number of graphene layers and nanoflake lateral sizes on irreversible/reversible capacities [4]. Our approach, compatible with any printing technologies, is cheap and scalable and opens up new opportunities for the development of high-capacity Li-ion batteries.

## References

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