

Beyond the lab: Scalable production of electrochemically exfoliated graphene / transition metal oxide hybrids for wearable energy storage

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The remarkable properties of graphene give this 2D-material the potential to be a competitive material for a broad range of industrial and commercial applications. Some of these characteristics are a high theoretical capacitance and electrical conductivity, giving graphene great potential for energy storage. However, large-scale production is still a key challenge to overcome in the path to commercial viability. The electrochemical exfoliation method has been described as a facile, scalable and green approach to producing a high amount of low-defect, large-lateral-size graphene (EG) [1]. The large lateral size and high aspect ratio make this graphene ideal for use in wearable thin-film supercapacitor devices. Additionally, the process can be modified to functionalize the graphene flakes [2]. In this work, we describe a simple modification to the electrochemical exfoliation process to decorate the EG flakes with manganese oxide to improve the energy storage performance. The material is produced in large scale by Sixonia Tech GmbH technology, with the developed inks/pastes having been used by our industrial partner (Elmeric GmbH) to fabricate series of supercapacitor devices. These were then integrated by Interactive Wear AG into a thermoregulatory shirt to power an embedded climate monitoring and control system.

REFERENCES

- [1] Martin R. Lohe, Xinliang Feng, Klaus Müllen, Sheng Yang, Patent EP3153605B1 / WO2017050689A1
- [2] Martin R. Lohe, Xinliang Feng, Ali Shaygan Nia, Patent DE102017223892A1 / WO2019129573A2

FIGURES

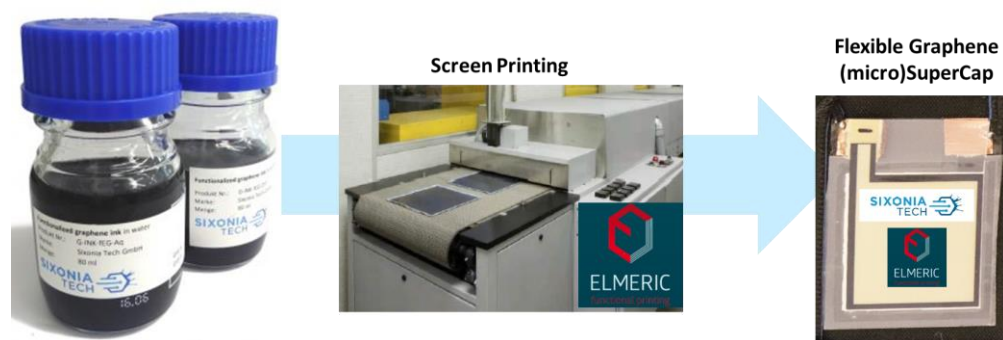


Figure 1: Simple diagram of EGTMO supercapacitor production process

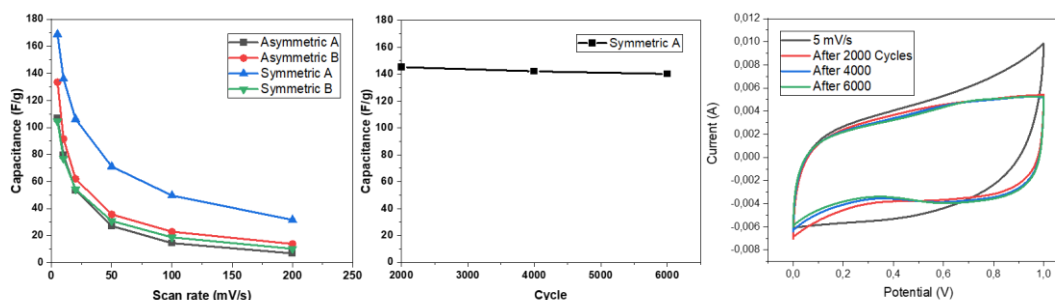


Figure 2: Performance of screen-printed EGTMO supercapacitor devices