Low-dimensional solution-processable electronics

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Propositions

accompanying the dissertation

LOW-DIMENSIONAL SOLUTION-PROCESSABLE ELECTRONICS

From field-effect transistor to artificial synapse

by

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1. The use of o-xylene instead of toluene as applicator solvent not only dramatically improves s-SWCNT ink shelf lifetimes, but also reproducibility and field-effect transistor performances. (Chapter 2)
2. Clever engineering on the nanoscale can reduce hysteresis; Inserting a small conjugated vinyl group into the head-to-head bithiophenes in the conjugated polymers PNDITEG-TVT and PNDIC8TEG-TVT can increase their backbone planarity and lower their bandgap, all without significantly sacrificing the wrapping ability. When used as wrapping polymer for s-SWCNT, this results in a reduced FET hysteresis, indicating a lower injection barrier. (Chapter 3)
3. Key factor in achieving high performance in Sn-based perovskite transistors is to reduce the p-doping level of the 3D perovskite by adding a tiny amount of 2D R-P phase, which significantly improves the crystallinity and orientation of the FASnI3. (Chapter 4)
4. Simple real-time square-shape pulses applied on two distinct electrodes can induce anti-Hebbian behavior in s-SWCNT transistors, imitating synapse functionality. (Chapter 5)
5. Performing science is much similar to building a house. A strong foundation is required for further development.
6. Field-effect transistors are great tools for assessing semiconducting ink quality.

7. Combining the personal skills and techniques of individual researchers working on seemingly unrelated topics unlocks potential and can result in outstanding achievements.

8. Pushing buttons is not science.

9. Allow your feelings; it allows for great thinking. In turn, this can lead to novel results.

10. Huge disadvantages can be exploited to become advantageous, or even an essential pre-requirement, for new materials and concepts.

11. The key to a proper break is the ability to fully disconnect from business-as-usual, both mentally and physically. This includes all methods of communication. Only then, a mind can be fully refreshed.

12. Pursuing a PhD is also about moving on from a seemingly fruitless project then, appreciating the very idea being realized by others, and swallowing the regret with a scoop of tear.

These propositions are considered defendable and as such have been approved by the promotor Prof. M. A. Loi.