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Popular science abstract: Patterning of perovskite thin films for electrical and optical characterisation

Research into clean energy technologies has become increasingly more important over the last few decades, spurned by growing popular demand and fear of climate change. As silicon solar cells approach their theoretical efficiency limit, emerging technologies may hold the key to even more efficient solar cells.

One such technology is that of perovskite solar cells, which have risen from 3.8% efficiency to 25.2% in just a decade. Additionally, perovskites can be processed from a liquid phase, allowing for large scale processing methods like those used for plastics. This makes production significantly cheaper when compared to conventional solar cells. However, their high solubility also makes perovskites difficult to process, which has so far limited study of their electrical properties and limited integration with other technologies.

In order to study semiconductors and create functional devices, the materials need to be patterned. That is, the shape of the material needs to be under direct control of the researcher so that the semiconductor conforms to the shape required for the experiment. This microscopic patterning of perovskites has proven difficult, as patterning methods were primarily developed for more stable semiconductors like silicon. When using these methods to pattern perovskites, they will generally be damaged during the processing. In order to achieve the microscopic patterning necessary to study the semiconductor properties of perovskites, new processing methods must be created.

The processing methods discussed in this thesis allow for the creation of such microscopic perovskite devices. Furthermore, understanding obtained from these devices can then be applied to further increase the efficiency of perovskite solar cells, while the processing methods can be used to integrate perovskites with already existing semiconductor technologies.

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