# Deep-UV transparent conducting $SrSnO_3$ freestanding sheet using $Al_2O_3$ protection layer

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Flexible and functional perovskite oxide sheets with high orientation and crystallization are the key step forward to next-generation devices. One promising synthesis method is a lift-off and transfer method by etching a water-soluble sacrificial layer between the oxide film and substrate. This method has many advantages, such as easily adds flexibility to perovskite oxides and allows the reuse of expensive single-crystal substrates. However, there is still one crucial problem; that is the difficulty to suppress cracks during the lift-off process. In this study, we demonstrated that this problem can be solved by simply adding an amorphous $Al_2O_3$ capping layer on the oxide sheet.

Through this method, a 5 × 5 mm crack-free La-doped $SrSnO_3$ (LSSO) flexible sheet was obtained, whereas the sheets broke into pieces without covered by the capping layer. The freestanding LSSO flexible sheets were able to be rolled and spread repeatedly using mechanical forces, such as airflow generated by washing ear ball and/or manual vibration, demonstrating the excellent flexibility and elasticity of the sheet. (Fig. 1). In addition, the sheet exhibited coexistence of high electrical conductivity (~1600 S $cm^{-1}$) and wide bandgap (~4.4 eV) at room temperature, indicating the great potential of the LSSO sheets as wide-bandgap transparent electrodes for deep ultraviolet-related devices.

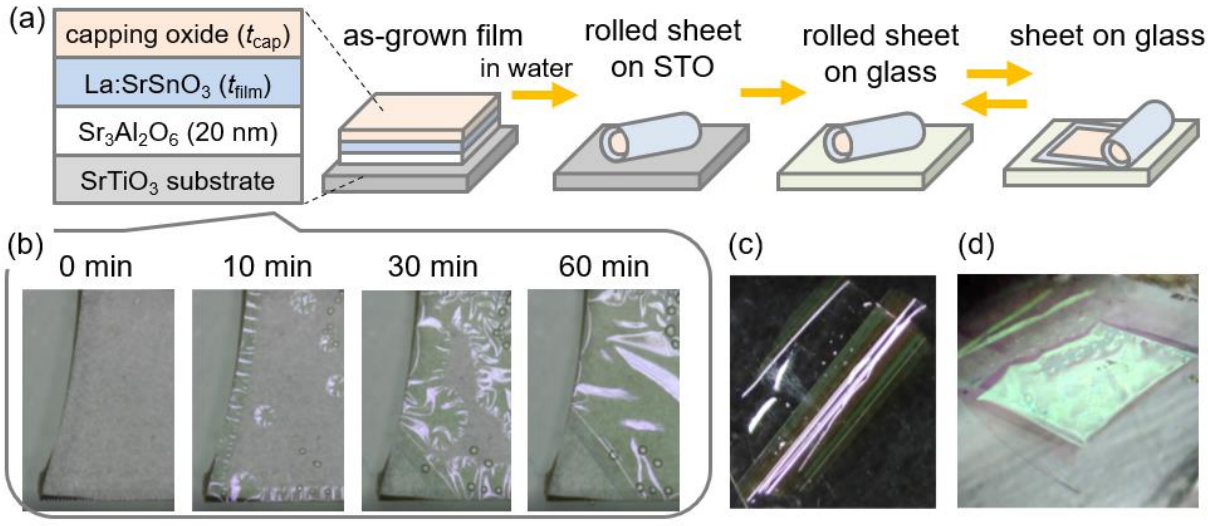


**Figure 1.** Behavior of the sheets without adhesive. Schematic images of the (a) transfer on no adhesive glass substrate. (b) Time-lapse photographs of the as-grown film directly immersed into deionized water. Photograph of (c) rolled film and (d) spread film on glass.

## Reference

[1] L. Gong *et al*., ACS Nano *in press*. (DOI: 10.1021/acsnano.2c08649.)