# Supplementary material

## Real-time coloration control of gallium based strips through cold rolling

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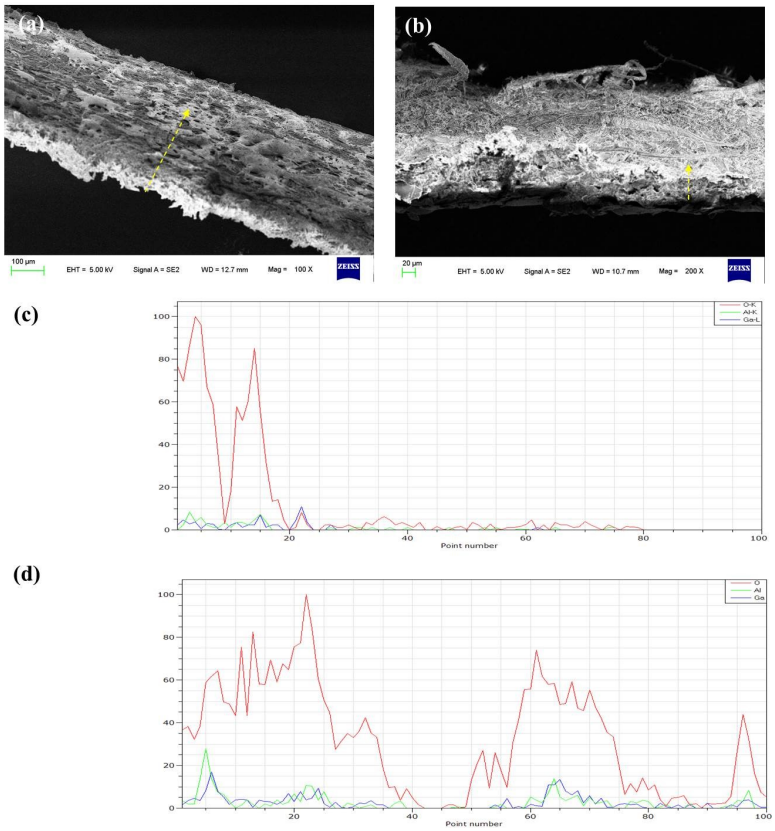


**Figure. S1** (a), (b) Cross-section views of colorless strip and dark brown strip; (c), (d) Line scanning marked by yellow dot line in Figure. S1(a) and S1(b).

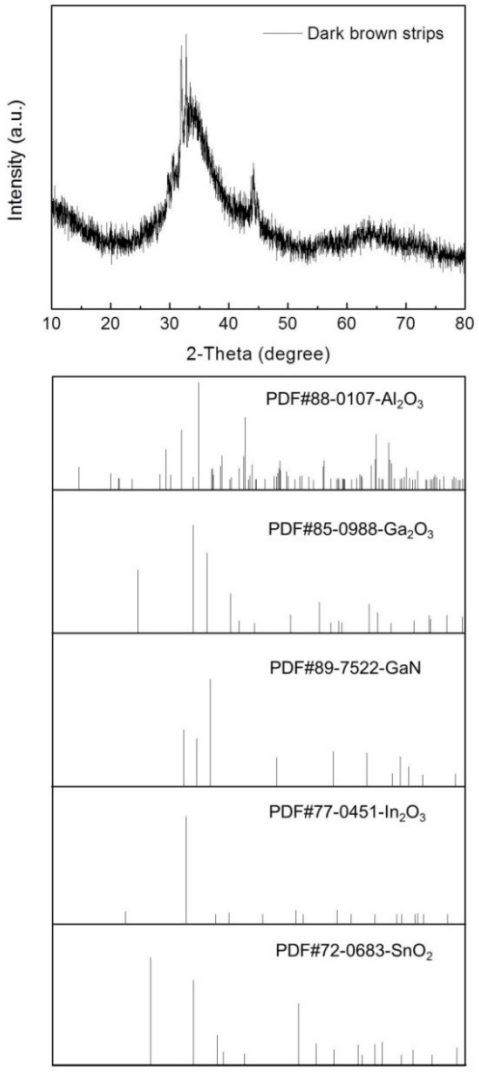


**Figure. S2** XRD result of dark brown colored strips

XRD results of strips with dark brown color were presented in Figure. S2. Note that the XRD samples were obtained by treated strips in a 0.01M hydrochloric acid aqueous solution for separate the LM. Then, fragments were collected by room temperature centrifuging and baking at 95℃. The XRD of the obtained strips showed poor crystallinity by the low intensity and wide peaks. Several peaks at around 35, 45, and 65 (broad) degrees of XRD results should be the overlapping peaks of $Al_2O_3$, $Ga_2O_3$, $SnO_2$, $In_2O_3$, and other plausible materials. However, due to the instability of protoxide under weak acid and high temperature, such as $Ga_2O$, $In_2O$ and SnO were not found.

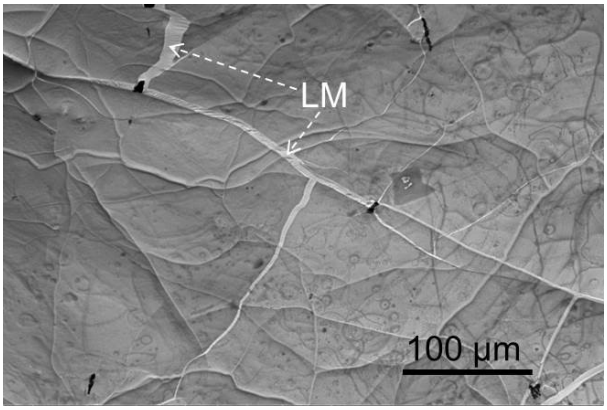


**Figure. S3** Microstructure of the colored strip surface

Figure. S3 shows that due to the rupture of the surface oxide film caused by compression and the promotion of LM (white area) upwelling along the cracks.

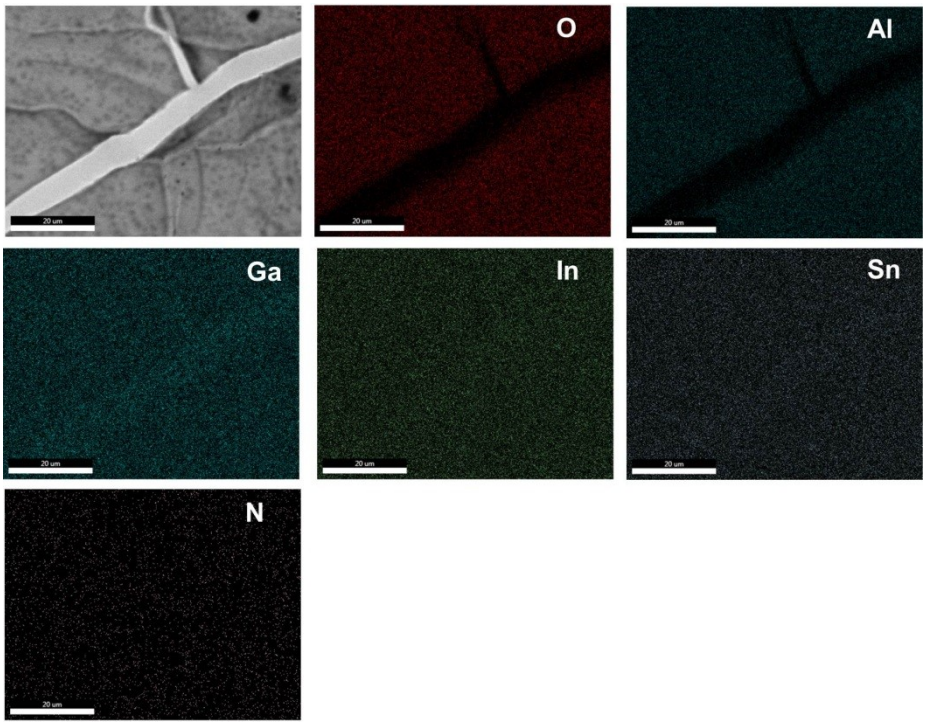


**Figure. S4** EDS mapping results on the surfaces of the colored strips

**Table S1** Color Performances of LM based strips

| Point | L* | a* | b* |
|---|---|---|---|
| I | 60 | 28 | -15 |
| II | 57 | 26 | 19 |
| III | 66 | 10 | 41 |
| IV | 53 | -7 | 37 |
| V | 20 | 8 | 13 |
| Silver white | 84 | 0 | 9 |
| Brown | 54 | 9 | 26 |