Supporting Information

Localized mechanical stress induced ionic redistribution in a layered $LiCoO_2$ cathode

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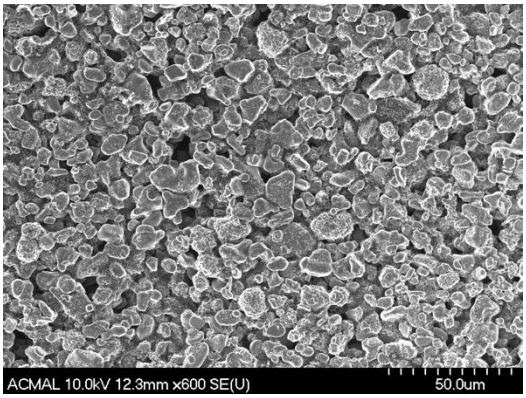

Figure S1. SEM image of the polycrystalline $LiCoO_2$ thin film.

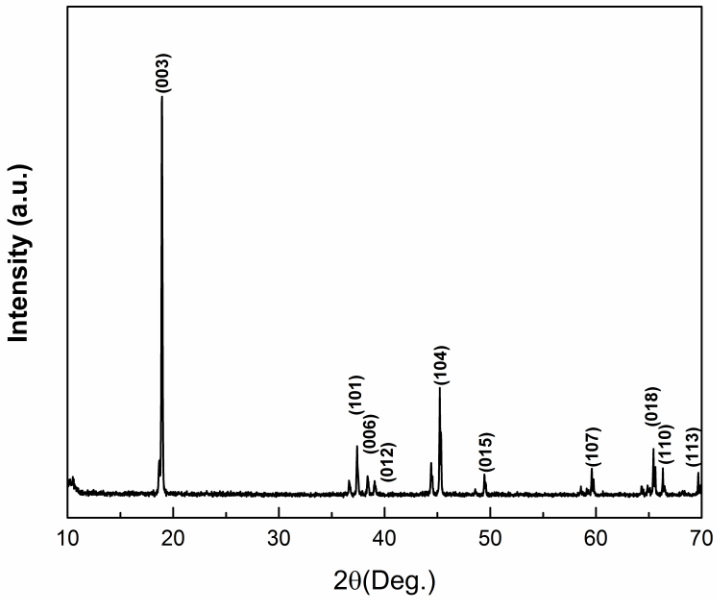

Figure S2. XRD pattern of the polycrystalline $LiCoO_2$ thin film. Non-indexed peaks at 37.4° and 44.4° correspond to Co_3O_4 phase (JCPDS 80-1544), which shall come from the manufacturing process.

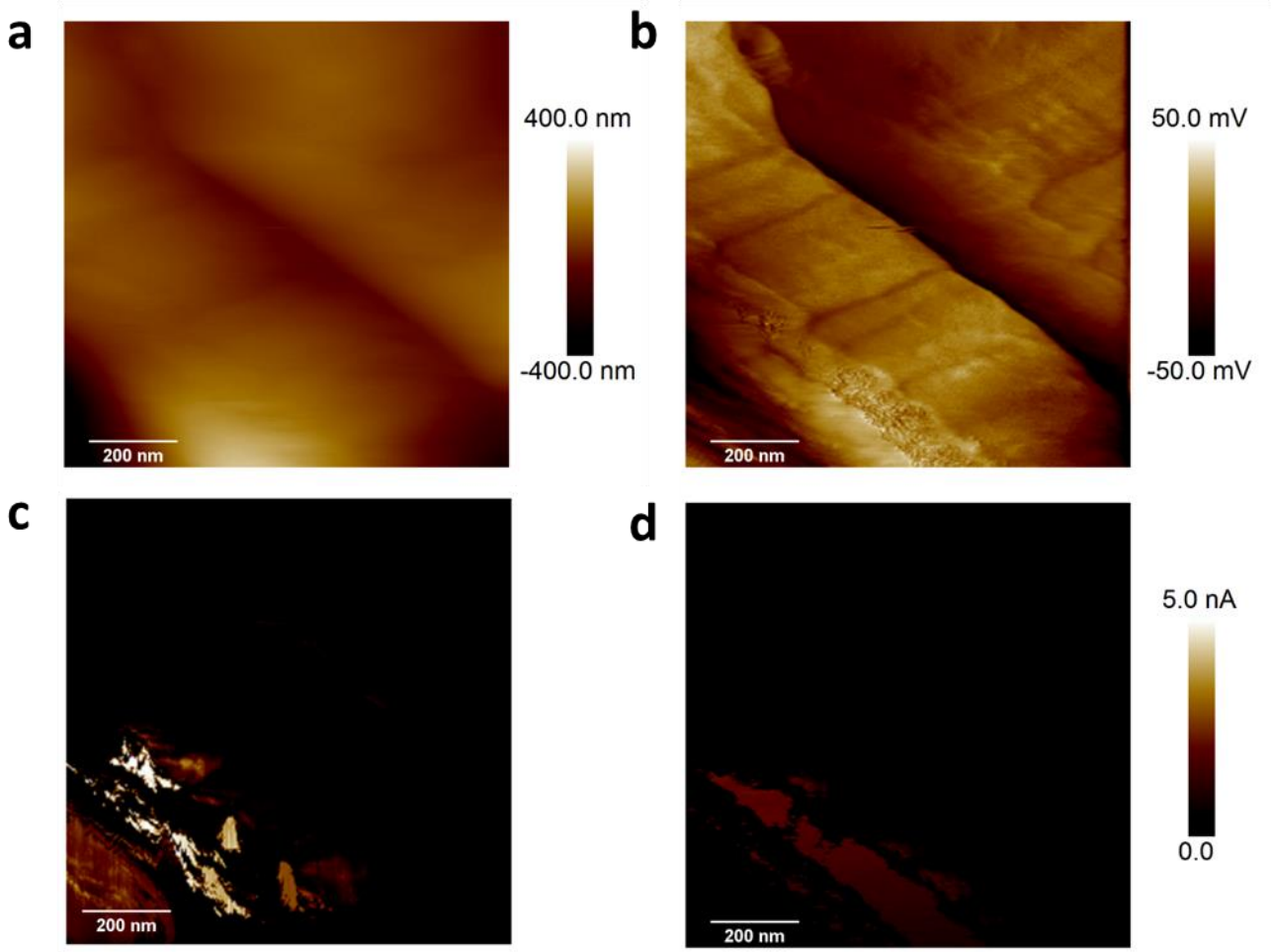

Figure S3. Height (a) and deflection (b) images from the $LiCoO_2$ thin film substrate. Electrical current mapping under a DC biased voltage of 2V at scan direction of 0 degree (c) and 90 degree (d). Figure S3d was rotated back 90 degree for better comparison with Figure S3c.

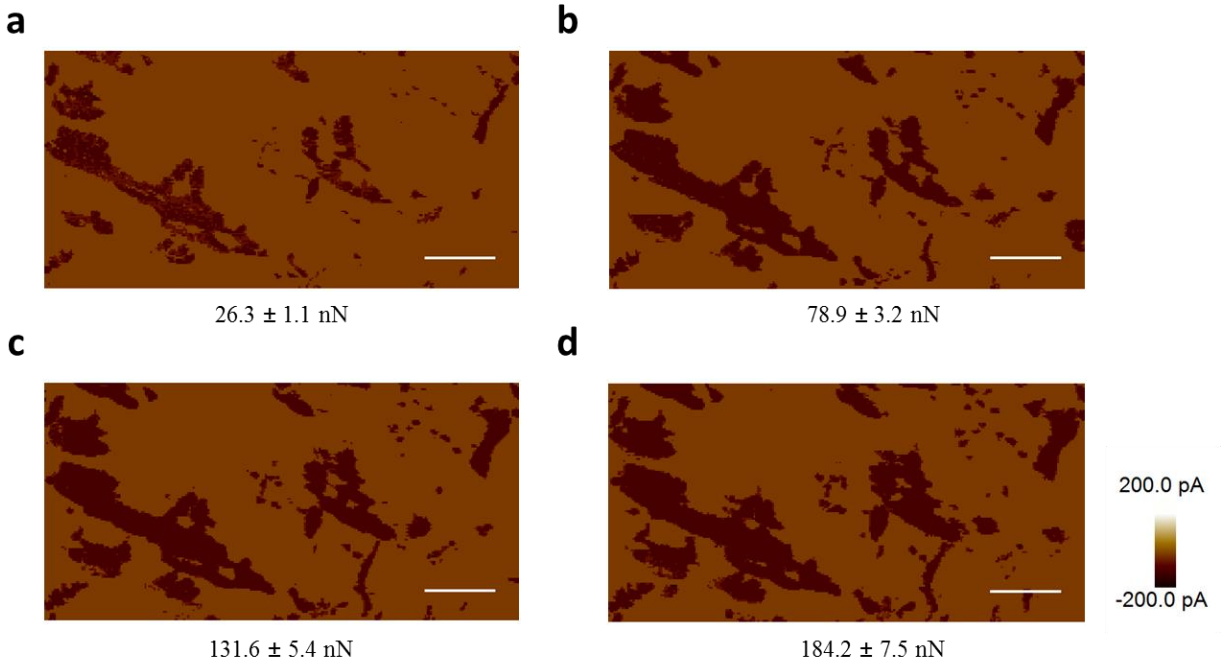

Figure S4. Electric current mapping of the corresponding area without a bias voltage in the layered $LiCoO_2$ substrate during the stress loading process under an applied force of (a) 26.3 nN, (b) 78.9 nN, (c) 131.6 nN, and (d) 184.2 nN, respectively. Scale bars are 300 nm.

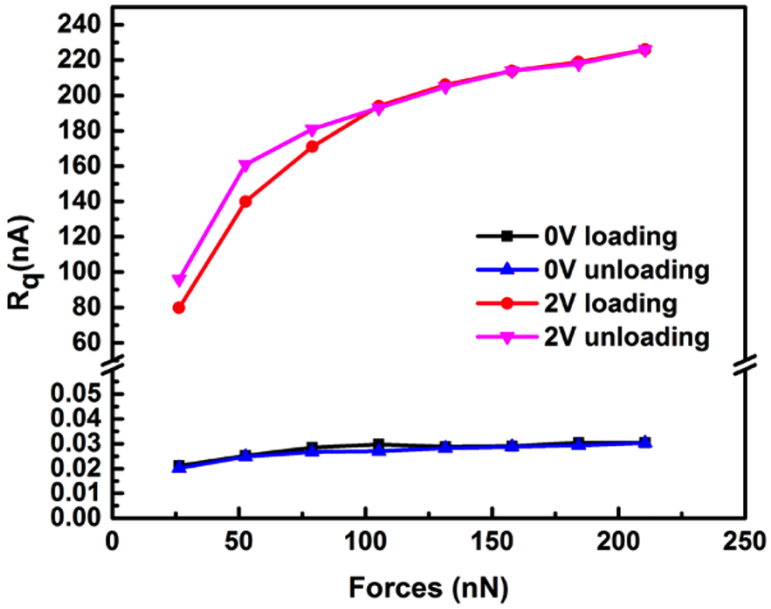

Figure S5. Root mean square roughness (R_q) of electrical current from $LiCoO_2$ thin film as a function of applied forces under a DC voltage of 0V and 2V.

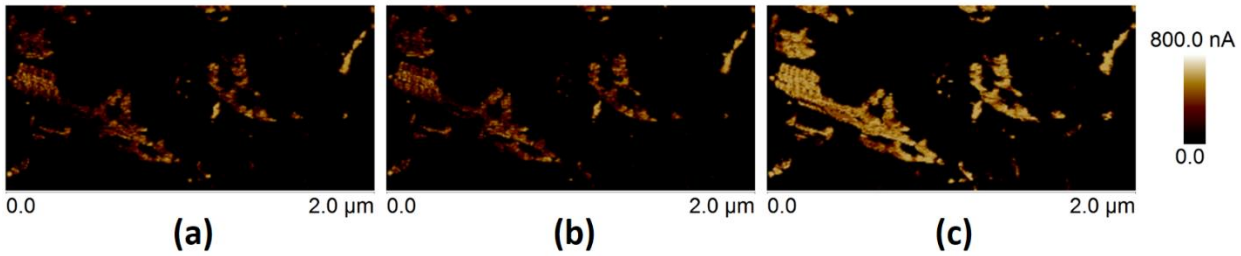

Figure S6. Electrical current images obtained under an applied force of 26.3 nN at (a) 0 min and around (b) 5 min. And (c) current images obtained at around 10 min with an applied force of 52.6 nN. The applied DC bias voltage was 2 V.

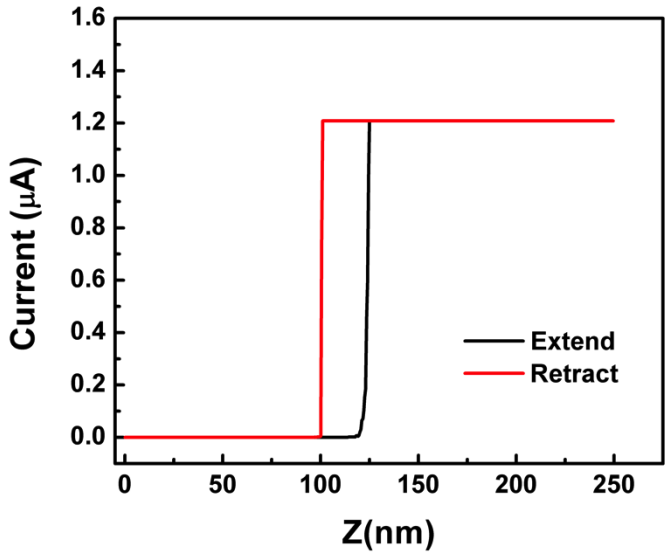

Figure S7. Ramp the tip-sample distance Z (distance between the substrate and the cantilever rest position) versus current output at spot 5 (Figure 3).

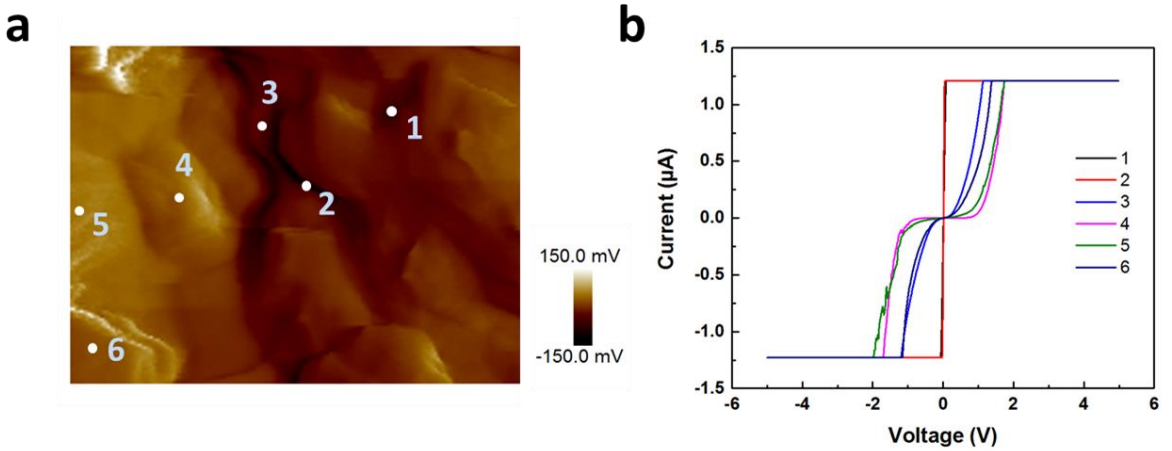

Figure S8. (a) Deflection image obtained on the layered $LiCoO_2$ thin film. (b) Representative I/V curves obtained inside the grain interiors (Spot 4, 5), close to grain boundaries (Spot 3, 6), and along the grain boundaries (Spot 1, 2).

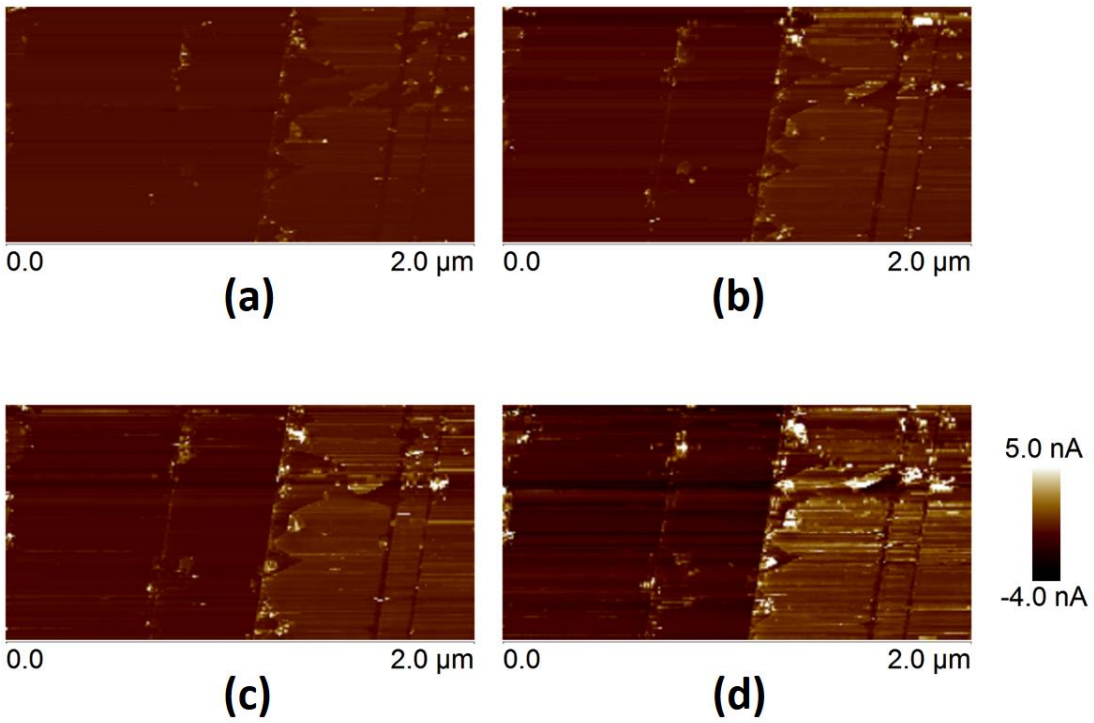

Figure S9. Electrical current images obtained on the HOPG substrate under an applied force of (a) 26.6 nN, (b) 79.9 nN, (c) 133.2 nN and (d) 213.1 nN. The applied DC bias voltage was 2 V.

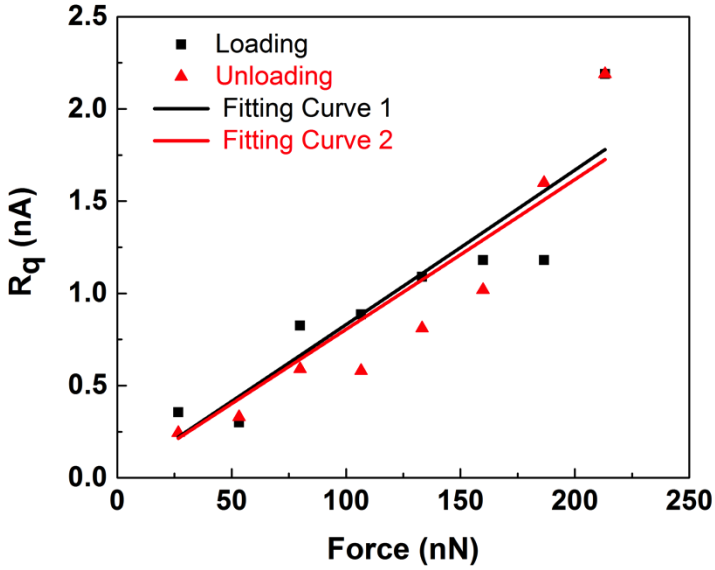

Figure S10. Root mean square roughness (R_q) of electrical current from HOPG substrate as a function of applied forces with nonlinear curve fitting.

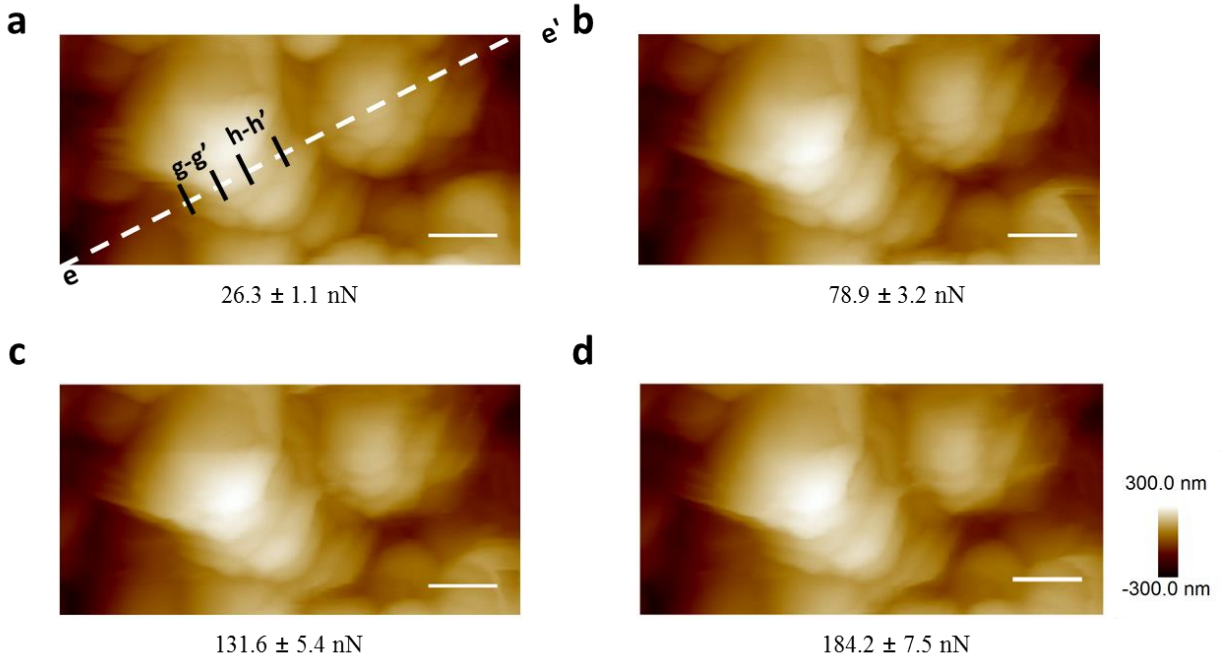

Figure S11. Height evolution of the corresponding area in the layered $LiCoO_2$ substrate under a bias voltage of 2V under an applied force of (a) 26.3 nN, (b) 78.9 nN, (c) 131.6 nN, and (d) 184.2 nN, respectively. Scale bars are 300 nm.

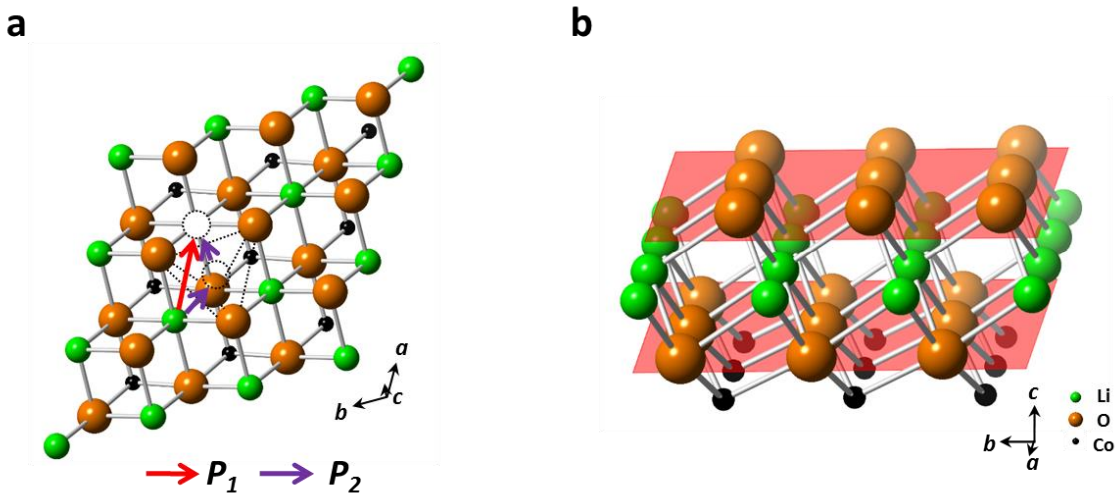

Figure S12. (a) Two mechanisms proposed for the diffusion of lithium ions along the (001) plane in the layered $LiCoO_2$ substrate. (b) lateral view of the lithium ion diffusion layer between two close-packed oxygen layers.