Supporting Information

Direct imaging and manipulation of ionic diffusion in mixed electronic-ionic conductors

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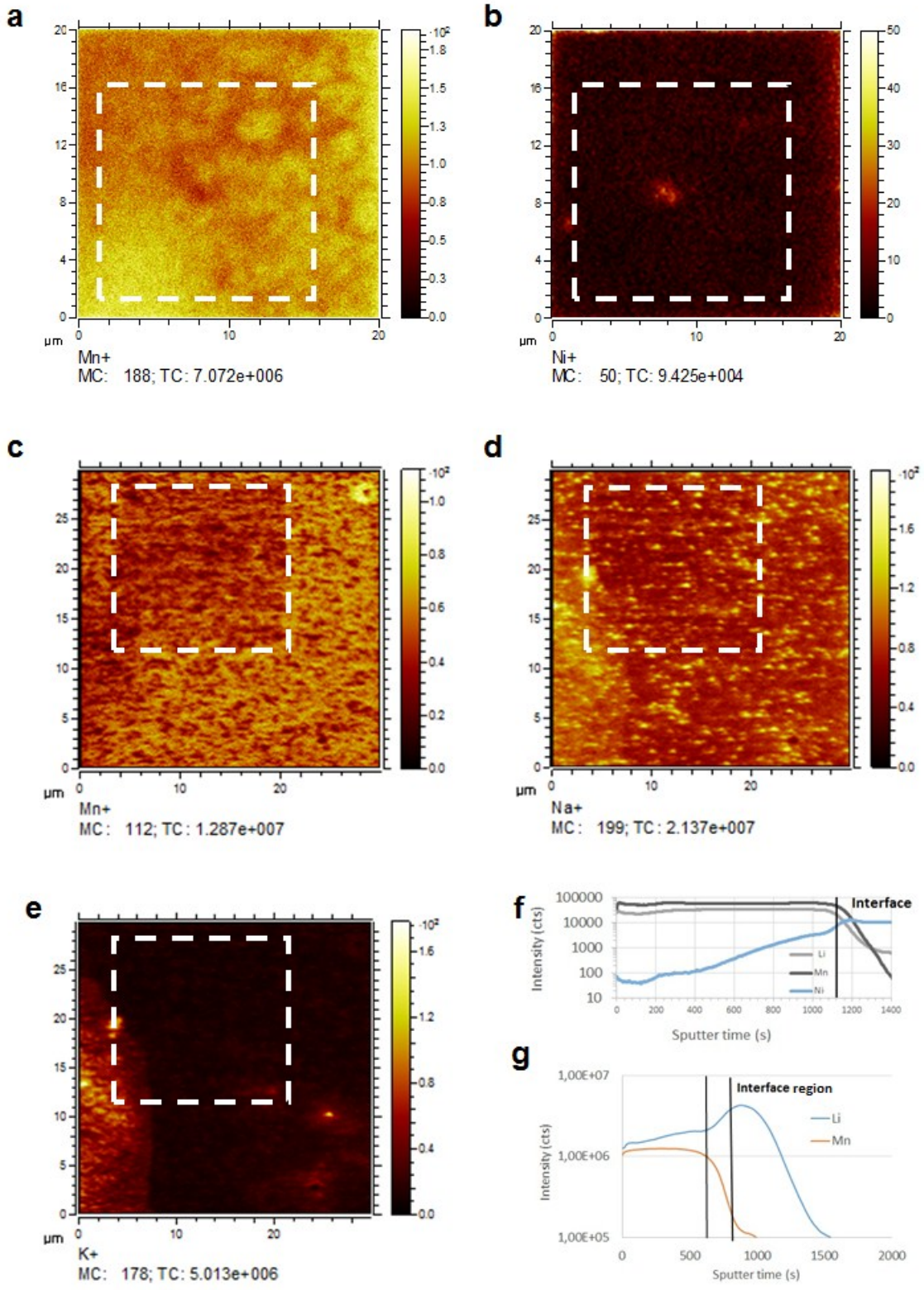
a
Mn+
MC: 188; TC: 7.072e+006
b
Ni+
MC: 50; TC: 9.425e+004
c
Mn+
MC: 112; TC: 1.287e+007
d
Na+
MC: 199; TC: 2.137e+007
e
K+
MC: 178; TC: 5.013e+006
f
Interface
Intensity (cts)
Sputter time (s)
Li
Mn
Ni
g
Interface region
Intensity (cts)
Sputter time (s)
Li
Mn

Figure S1. Elemental analysis by SIMS. The chemical maps at the top surface of the other elements detected for the Figure 2c (electrodeposited LMO) of the main text are shown: in **(a)** Mn^+ **(b)** Ni^+. Similarly in **(c)** Mn^+ **(d)** Na^+ and **(e)** K^+ maps are shown for the RF-sputtered LMO. For both cases the pre-scanned area is indicated by a white square. The depth profiles showing the Li^+ distribution reaching the bottom electrode interface are presented in **(f)** and **(g)**.

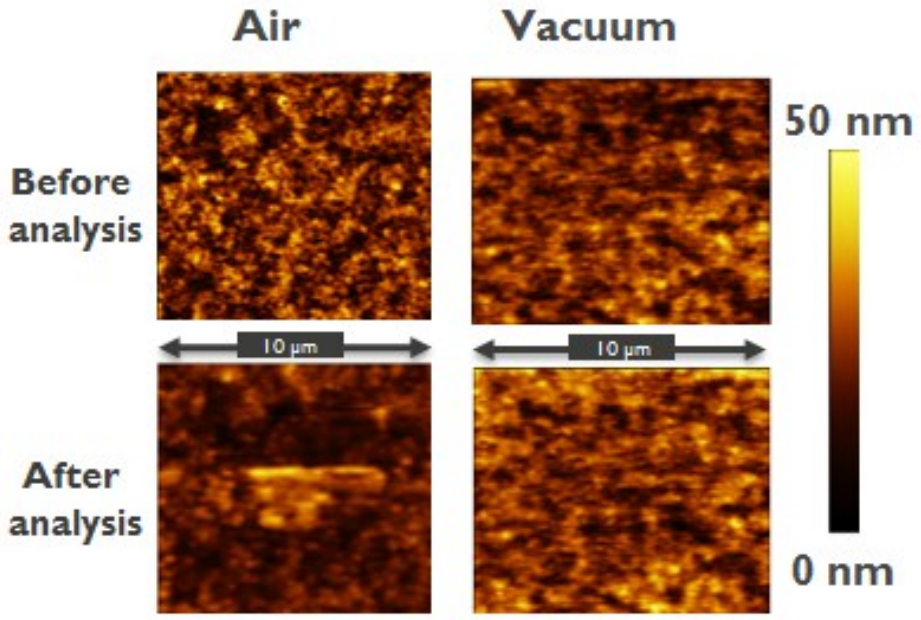

Figure S2. Tip-induced surface modification. Morphological surface changes are consistently observed when the measurements are performed in air. The latter can be ascribed to undesired side reactions occurring in presence of the meniscus (absorbed water layer). The reactive lithium can form a number of detrimental composites on the top surface in ambient conditions. This is due to a electrolytic half-cell which is formed by the presence of a water meniscus between tip and sample. This water layer can act as a Li-ion reservoir and in combination with an applied electric field at the AFM tip it can induce multiple oxidation procedures leading to the formation of

protrusions as seen in the case of air. For this reason our measurements are performed in high vacuum (below 10-6 mbar), where the undesired effect is suppressed as in Figure 1.