Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

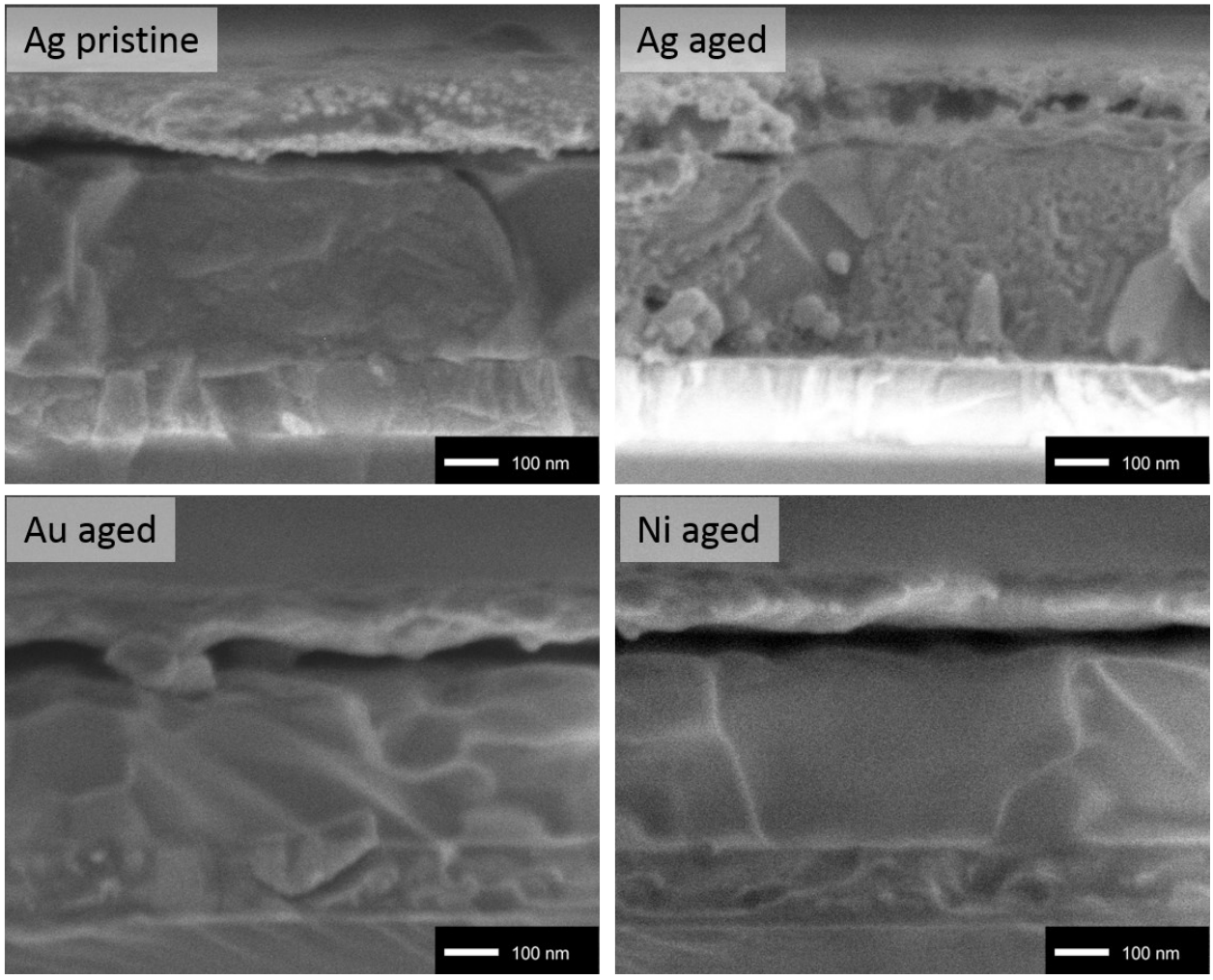

Figure 1. Cross section SEM microphotographs of pristine PSC with Ag and aged PSCs with Ag, Au and Ni contacts.

1. Cross-section SEM microphotographs of aged PSCs with different contact

The images indicate a strong morphological change of Ag layer, while the Au and Ni contacts retain their initial morphology. This observation is in full agreement with our investigations.

2. Adhesion tape test

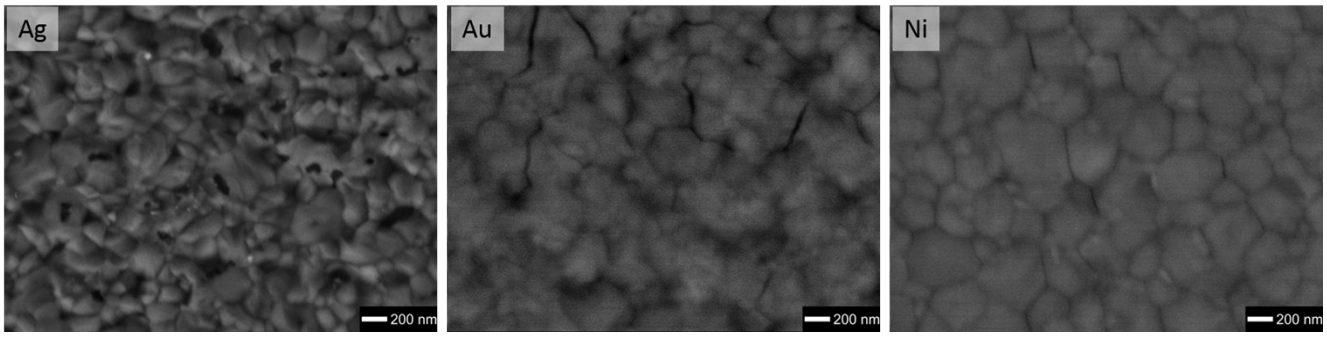

Figure 2. Adhesion test of Ag, Au and Ni contacts on the top of MAPI/C60/BCP after 2-week storage in air.

3. IS measurements

Following equations were used for fitting the impedance measurements:

$$Z^{'} = R_{ser} + \frac{R_{per/TL}}{1 + R_{per/TL}^{2}\omega^{2}C_{per/TL}^{2}}$$

$$Z^{''} = -j\frac{R_{per/TL}^{2}\omega C_{per/TL}}{1 + R_{per/TL}^{2}\omega^{2}C_{per/TL}^{2}}$$

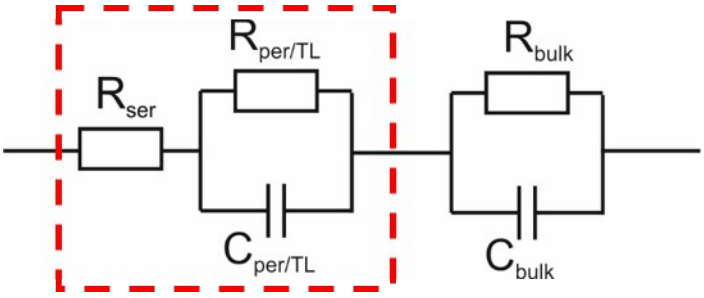

Figure 3. Equivalent electrical circuit for IS measurements

Table 1. Fitting parameter for IS measurements

	Au	Ni	Ag
pristine	R_{ser} = 15.1 Ω $C_{per/TL}$ = 2.1E-8 F $R_{per/TL}$ = 40.7 Ω	R_{ser} = 11.7 Ω $C_{per/TL}$ = 1.1E-8 F $R_{per/TL}$ = 35.1 Ω	R_{ser} = 15.9 Ω $C_{per/TL}$ = 1.1E-8 F $R_{per/TL}$ = 83.9 Ω
2-week air storage	R_{ser} = 29.2 Ω $C_{per/TL}$ = 2.4E-8 F $R_{per/TL}$ = 248.9 Ω	R_{ser} = 19.6 Ω $C_{per/TL}$ = 1.1E-8 F $R_{per/TL}$ = 72.8 Ω	R_{ser} = 156.5 Ω $C_{per/TL}$ = 5.8E-9 F $R_{per/TL}$ = 1745,7 Ω

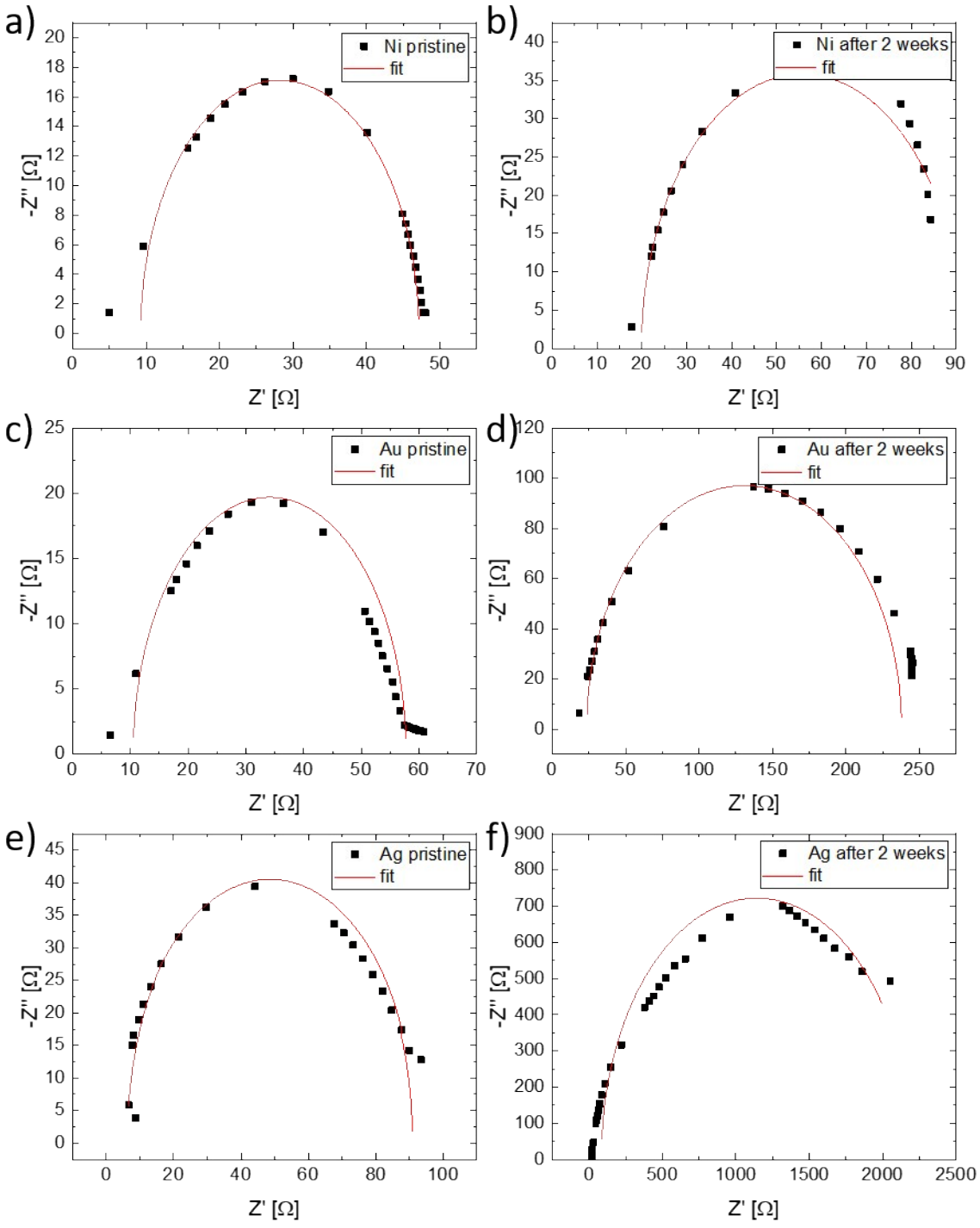

Figure 4. IS measurements at pristine (a, c, e) and 2-week old (b, d, f) PSCs with Ag (a,b), Au (c, d) and Ni (e,f) contacts.

4. EDX mapping of cross-section of pristine and two-month-old devices.

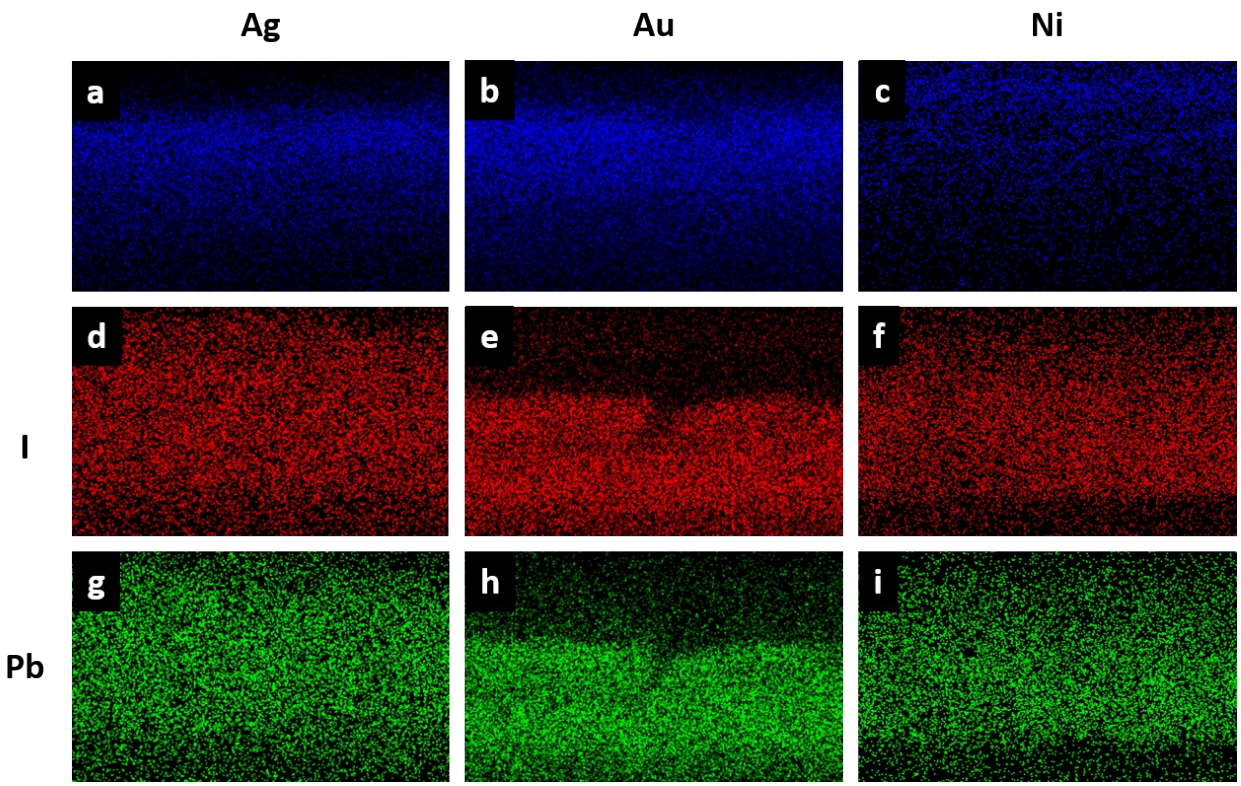

Figure 5. Cross section EDX mapping of pristine PSCs with Ag, Au and Ni contacts. Metals, iodide and lead are presented with blue, red and green colors respectively.

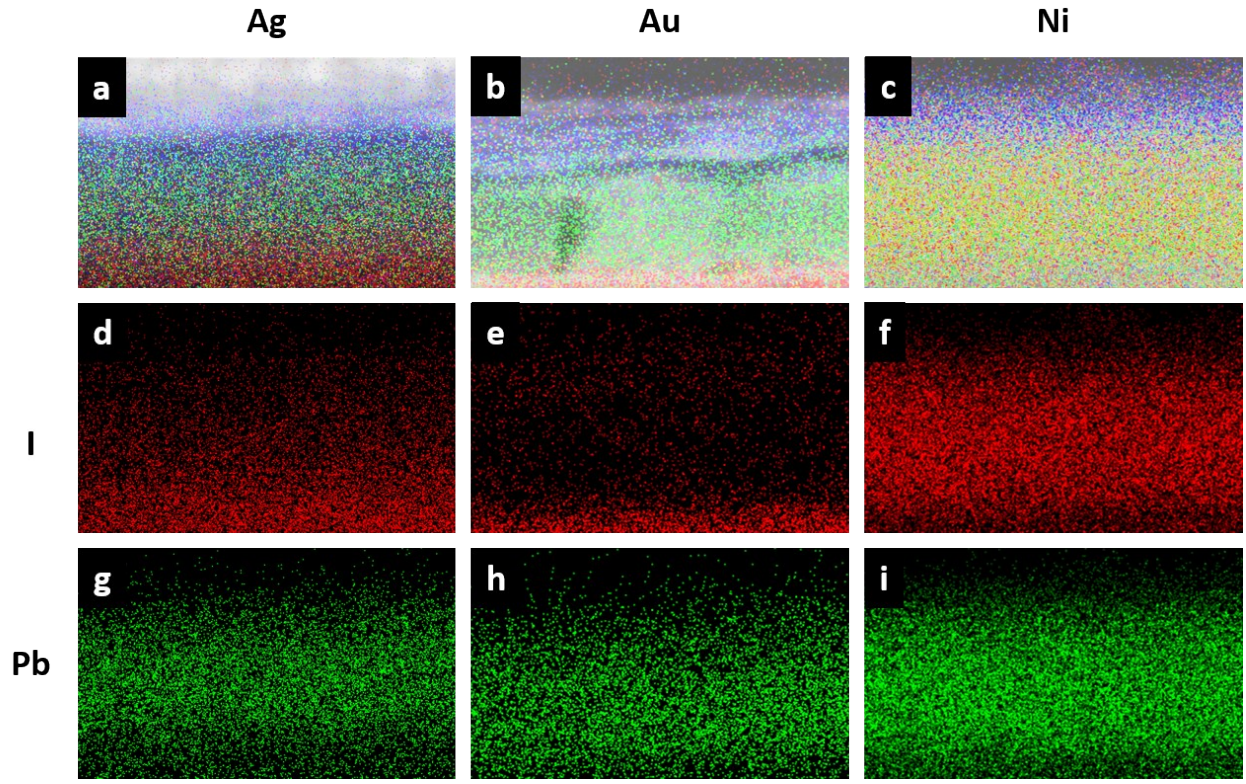

Figure 6. Cross section EDX mapping of 2-month old PSCs with Ag, Au and Ni contacts. Metals, iodide and lead are presented with blue, red and green colors respectively.

5. J-V curves of Ni-cathoded devices measured in forward and reverse directions

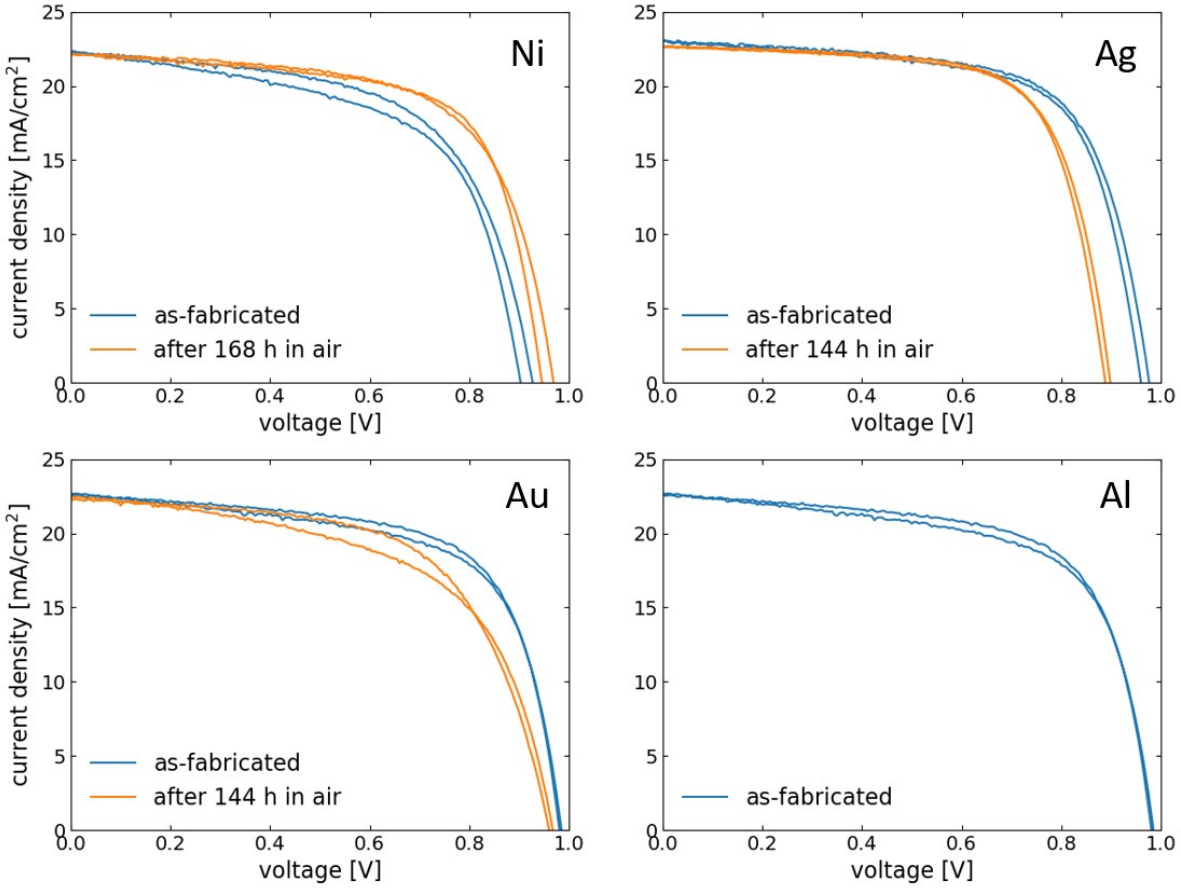

Figure 7. Forward and reverse J-V measurements of as-fabricated devices and after storage in air for several days

As the presence of the hysteresis in perovskite solar cells is an important topic and may strongly influence the calculated performance of the devices, we have measured the hysteresis of the J-V characteristics (Fig. 7). The observed hysteresis for all devices including Ni-based solar cells is small and, therefore, does not falsify our interpretation of the device parameters.

6. Calculation of power conversion efficiency (PCE) from power at maximum power point (P_{MPP})

In our experiment we have performed the tacking of the maximum power point manually by measurement of J-V characteristics and consequently calculation of power at MPP (P_{MPP}). For this purpose, the power ($P=V*I$) vs. voltage plot was analyzed for each measurement. The determined MPP was then used to calculate the correct PCE according to the standard equation:

$$PCE = P_{MPP} / P_{in} \times 100$$

, where P_{in} = 100 mW/cm^2.