Composition analysis of two different PEDOT:PSS commercial products used as an interface layer in Au/n-Si Schottky diode

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Supporting Information

According to Cheung model current–voltage characteristics due to TE theory of SBDs can be expressed as:

\[
\frac{dV}{d(\ln I)} = I R_s + \frac{n k T}{q} \tag{1}
\]

Figure S1 [(a) and (b)] shows the \(dV/d(\ln I)\) vs. \(I\) curves at temperatures range 290 K to 380 K. This plot follows a linear behavior where its slope gives the series resistance (\(R_s\)) and intercept gives the ideality factor (\(n\)). The value of \(R_s\) and \(n\) are obtained from the plot. Using the calculated ideality factor, the effective barrier heights are evaluated by another equation of Cheung, defined as:

\[
H(I) = V - n \frac{k T}{q} \ln \left( \frac{I}{AA^* T^2} \right) = n \phi_{b0} + R_s I \tag{2}
\]

Figure S1 [(c) and (d)] shows a plot of \(H(I)\) vs. \(I\) at temperatures same range. Again this plot also follows a straight line with intercept equal to \(n \phi_{b0}\). The calculated values of \(n\), \(\phi_{b0}\) and \(R_s\) are shown in table 1.
**Figure S1**: Temperature dependent plot of $dV/d(\ln I)$ vs. $I$ and $H(I)$ vs. $I$ for Au/PH1000/n-Si and Au/HTL Solar/n-Si SBDs.

**Table 1**: Temperature dependent electrical parameters of Au/PH1000/n-Si and Au/HTL Solar/n-Si SBDs determined from $I$–$V$–$T$ characteristics.

| T(K)  | Au/PH1000/n-Si | Au/HTL Solar/n-Si |
|-------|----------------|-------------------|
|       | TE Theory      | Cheung Equation   | TE Theory | Cheung Equation |
|       | $n$  | $\varphi$ | $R_s$  | $n$  | $\varphi$ | $N$  | $\varphi$ | $R_s$  |
| 290   | 4.63 | 0.680      | 3.92    | 0.818 | 34.05     | 3.25 | 0.692      | 3.01    | 0.877     | 12.96   |
| 300   | 4.08 | 0.701      | 3.81    | 0.848 | 21.08     | 3.12 | 0.713      | 2.89    | 0.899     | 11.75   |
| 310   | 3.66 | 0.723      | 3.78    | 0.867 | 15.14     | 2.99 | 0.729      | 2.58    | 0.926     | 11.11   |
| 320   | 3.32 | 0.744      | 3.11    | 0.905 | 14.01     | 2.83 | 0.747      | 2.43    | 0.944     | 10.01   |
| 330   | 3.1  | 0.763      | 2.56    | 0.957 | 12.15     | 2.78 | 0.778      | 2.21    | 0.980     | 9.35    |
| 340   | 2.96 | 0.778      | 2.45    | 0.973 | 10.27     | 2.68 | 0.775      | 2.00    | 0.986     | 8.92    |
| 350   | 2.84 | 0.795      | 2.35    | 0.982 | 9.39      | 2.55 | 0.792      | 1.84    | 1.008     | 8.44    |
| 360   | 2.69 | 0.813      | 2.12    | 1.002 | 9.11      | 2.49 | 0.805      | 1.68    | 1.026     | 8.02    |
| 370   | 2.62 | 0.839      | 1.85    | 1.041 | 9.41      | 2.38 | 0.833      | 1.58    | 1.044     | 7.48    |
| 380   | 2.73 | 0.835      | 1.77    | 1.048 | 8.87      | 2.36 | 0.834      | 1.43    | 1.062     | 7.37    |
Figure S2: Richardson plots of the \( \ln(I_0/T^2) \) vs. \( 1000/T \) for Au/PH1000/\( n \)-Si and Au/HTL Solar/\( n \)-Si SBDs at the temperature range from 290 K to 380 K.

Figure S3: \( \Phi_{ap} \) vs. \( 1000/T \) plot of Au/PH1000/\( n \)-Si and Au/HTL Solar/\( n \)-Si SBDs.