Supporting information

N-ion-implanted TiO$_2$ photoanodes in quantum dot-sensitized solar cells

P. Sudhagar, a K. Asokan, b E. Ito, c Yong Soo Kang *a

E-Mail: kangys@hanyang.ac.kr

S1. Estimation of N ion implantation depth profile in TiO$_2$ lattice

**Fig. S1.** SRIM2008 simulation of the depth profile of the implanted N atoms for N-H-TiO$_2$ electrode.
**S2. XPS survey**

**Fig. S2.** C1s core level spectra of pristine and N ion implanted TiO$_2$

**Table S1.** Peak positions of Ti2p and O1s estimated from XPS spectra.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Ti2p$_{3/2}$ (eV)</th>
<th>O1s (main) (eV)</th>
<th>O1s (shoulder) (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TiO$_2$</td>
<td>459.5</td>
<td>530.7</td>
<td>532.4</td>
</tr>
<tr>
<td>N-TiO$_2$</td>
<td>459.3</td>
<td>530.7</td>
<td>532.1 533.3</td>
</tr>
</tbody>
</table>

Fig.S2 displays the O1s core level spectra of TiO$_2$ and N-TiO$_2$ samples. From Fig.S2 it observed that intensity of O1s main feature at 530.7 eV decreased by N ion implantation which endorse the occupancy of N ions in the oxygen vacancies. On the other hand feature at around 533 eV seems to slightly increase may due to OH group adsorption assumed as surface contamination.
**S3. Optical absorption of QDs sensitized electrodes**

![Absorption Spectra of CdSe QDs Sensitized H-TiO<sub>2</sub> Electrodes](image)

**Fig. S3.** Optical absorption spectra of CdSe QDs sensitized H-TiO<sub>2</sub> electrodes.

Fig. S3. Illustrates the absorption spectra of CdSe sensitized electrodes. From Fig. S3, the absorption onset is observed around 580-600 nm which reflects the CdSe band gap nature. Under similar CdSe sensitization conditions, the N-TiO<sub>2</sub> electrode shows higher absorption than that of the TiO<sub>2</sub>. We claim that the visible light is apparently improved by synergetic contributions from N ion implantation associated with CdSe QDs.
Fig. S4. (a) Equivalent circuit for impedance data analysis and (b) Bode characteristic plots of QDSCs with different photoanodes.