ENCAPSULATION INFLUENCE ON THE POTENTIAL INDUCED DEGRADATION OF CRYSTALLINE SILICONE CELLS WITH SELECTIVE Emitter STRUCTURES

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Abstract/Summary:
The encapsulation method of crystalline silicon modules plays an important role in the mitigation of potential induced degradation (PID) on module level. The focus on this work is to identify possibilities of mitigating PID for selective emitter cell technologies by the means of new module designs without the necessity of cell level modifications. In this paper we present different frontcover and encapsulation materials, which have been tested in different module layouts. We predominantly examined innovative laminate configurations allowing for higher transmission rates in the UV range and thus increasing short circuit currents (ISC) of selective emitter cells. We examined these performance (PMPP) enhancements consisting in higher optical transmission in relation to its resistance against PID. As a result of this assessment we show new module designs, which are both capable to improve module efficiencies while avoiding PID effects. Furthermore, different EVAs have been tested regarding their PID.

For more Information on the topic please contact the R&D Team of PI Berlin.

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Introduction
The encapsulation method of crystalline silicon modules plays an important role in the mitigation of potential induced degradation (PID) on the module level. The focus of this work is to identify possibilities of mitigating PID for selective emitter cell technologies by the means of new module designs without the necessity of cell level modifications.

In this paper we present different module designs without the necessity to its resistance against PID. As a UV stability of different embedding materials

<table>
<thead>
<tr>
<th>Material composition</th>
<th>( I_{SC} ) [W]</th>
<th>Normalized ( I_{SC} ) [%] (Measured)</th>
<th>Normalized ( I_{SC} ) [%] (Simulated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass/EVA (Reference)</td>
<td>8.60</td>
<td>100.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Glass/PVB</td>
<td>8.66</td>
<td>100.65</td>
<td>100.60</td>
</tr>
<tr>
<td>Glass/TPSE</td>
<td>8.54</td>
<td>99.30</td>
<td>99.31</td>
</tr>
<tr>
<td>Glass/Ionomer</td>
<td>8.25</td>
<td>99.50</td>
<td>99.95</td>
</tr>
<tr>
<td>Glass/PDMS</td>
<td>8.57</td>
<td>99.88</td>
<td>101.70</td>
</tr>
<tr>
<td>FEP/PDMS</td>
<td>8.83</td>
<td>102.65</td>
<td>103.50</td>
</tr>
</tbody>
</table>

The investigations show that in short and medium terms it is possible to generate a benefit from selective emitter cells in addition to the higher open circuit voltage within the module technology by changing the used materials. Alternative front sheets and encapsulants have been presented and tested for their initial performance. One aspect of long term stability - the UV resistivity - has been observed and the PID acceleration or deceleration of different embedding materials could be summarized. Furthermore, it could be shown that the variation in the PID behaviour is quite high within the material group of EVA, which is mostly used in the common module technology by changing the used materials.

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