

436 DURACIS

Advanced Global Encapsulation Solutions for Long Term Stability in Industrial Flexible Cu(In,Ga)Se₂ Photovoltaic Technology

Project duration: from 09.2017 to 12.2020

Report submitted: 01.2021

Summary

For a cost-competitive full market entry, flexible CIGS PV technologies require the availability of innovative encapsulation solutions with both very low costs and excellent barrier properties guaranteeing a long operating time of the devices. Even if there are already existing solutions with acceptable performance levels, costs remain a relevant issue that needs to be solved in order to keep the stringent cost reduction targets established for these technologies. To solve these problems, DURACIS has explored new alternative encapsulation and optical glue materials and concepts, compatible with their implementation into already existing industrial CIGS pilot lines and allowing a significant extension of the lifetime while substantially reducing costs. To achieve this goal, transfer of concepts previously developed for organic technologies (with very stringent encapsulation requirements) have been investigated, including innovative self-stratifying organic coatings, the development of ALD-based nanometric barrier layers and the development of new ionomer based encapsulants.

The project has adopted a global strategy including solutions for the main industrial substrate technologies that have been developed for flexible CIGS (polyimide, steel substrates) and has also included the analysis of their transfer into industrial pilot lines available in the consortium. The activities developed in the project have allowed to demonstrate the feasibility of the ALD based nanometric barriers for the effective encapsulation of CIGS devices at both cell and mini-module level, with an encapsulation performance comparable to that achieved with standard glass-glass encapsulation solutions. Cost analysis of the processes shows the potential to achieve a significant reduction of the complete packaging costs when combined with the ionomer-based encapsulant materials developed in the project and state-of-the-art (SOA) front sheets, with estimated costs in the range 15-20 €/m² that are close to the quantitative cost target that was defined in the project (15 €/m²). Very promising results in terms of compatibility with industrial processes, high optical quality, UV stability and very high flexibility have also been achieved with highly innovative self-stratifying organic coatings, however in this case further development is required for improvement of the barrier properties of these layers.

Project consortium

Coordinator and all contact details:

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Participating countries and financing:

Country	Number of organisations involved	Project costs in EUR	Public funding in EUR
Spain	2	364'410	185'750
France	2	346'342	178'982
Belgium-Wallonia	2	410'221	269'423
Germany	1	455'433	455'433
Austria	3	286'767	212'127
<i>Total</i>	<i>10</i>	<i>1'863'173</i>	<i>1'301'715</i>

Funding agencies involved and contracts

Funding Agency	Contract N° and Title
Agencia Estatal de Investigación -APCIN 2017	PCIN-2017-041 – DURACIS
Agence de l'Environnement et de la Maîtrise de l'Energie (ADEME)	N° 1705C0009 - DURACIS
Service Public de Wallonie	1610058 -DURACIS
Bundesministerium für Wirtschaft und Energie (BMWi) (via Projektträger Jülich, PTJ)	0324207 -Neuartige Verkapselungslösungen zurlangzeitstabilen industriellen Verkapselung flexibler Cu(In,Ga)Se ₂ Photovoltaik
FFG-Österreichische Forschungsförderungsges.m.b.H	858494 – DURACIS