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Concentrator photovoltaic (CPV) solar cells and cell on carrier (CoC) assemblies – qualification

Cellules solaires photovoltaïques à concentration (PVC) et ensembles de cellules sur support (CoC) – Qualification



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE



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CONTENTS

F	OREW	ORD	4			
1	Sco	pe	6			
2	Nor	mative references	6			
3	Terms and definitions					
4	Ope	Operating environment				
5	Sar	Sampling				
6	Mai	Marking				
7	Cha	aracterization methods for measuring the performance of hare cells and CoCs				
'	sub	jected to qualification tests	10			
	7.1	General	10			
	7.2	Light I-V measurement	10			
	7.3	Dark I-V measurement	11			
	7.3	.1 General	11			
	7.3	.2 Procedure	11			
	7.4	Electroluminescence (EL) mapping	11			
	7.5	X-ray and Scanning Acoustic Microscope (SAM)	12			
	7.6	Visual inspection	12			
	7.7	Thermal resistance measurement	12			
8	Pas	ss criteria	13			
9	Doo	cumentation and reporting	20			
1() Mo	difications and requalification	20			
1	l Qua	alification stress tests	21			
	11.1	General	21			
	11.2	ESD damage threshold	21			
	11.	2.1 General	21			
	11.	2.2 Purpose	21			
	11.	2.3 Procedure	22			
	11.	2.4 Requirements	22			
	11.3	Front and back metal adhesion	22			
	11.	3.1 Purpose	22			
	11.	3.2 Procedure	22			
	11.	3.3 Requirements	22			
	11.4	High-temperature storage	22			
	11.4	4.1 Purpose	22			
	11.4	4.2 Procedure	22			
	11.4	4.3 Requirements	∠3			
	11.5 11		∠ა ∽			
	11.	5.1 Fulpose	23			
	11	5.2 Requirements	24			
	11.6	High temperature with current injection	24			
	11	6.1 Purpose				
	11	6.2 Procedure	25			
	11.	6.3 Requirements	25			
	11.7	Low level light biased damp heat	25			
	11.	7.1 Purpose	25			

11.7.2	Procedure	25
11.7.3	Requirements	25
11.8 Solo	derability	26
11.8.1	Purpose	26
11.8.2	Procedure	26
11.8.3	Requirements	27
11.9 Illur	nination	27
11.9.1	Purpose	27
11.9.2	Procedure	27
11.9.3	Requirements	28
11.10 Wire	e/Ribbon bond strength	28
11.10.1	Purpose	28
11.10.2	Procedure	28
11.10.3	Requirements	30
11.11 Die	adhesion	31
11.11.1	Purpose	31
11.11.2	Procedure	31
11.11.3	Requirements	31
11.12 Con	nector shear strength	32
11.12.1	Purpose	32
11.12.2	Procedure	32
11.12.3	Pass/fail criteria	33
11.13 Byp	ass diode shear strength	33
11.13.1	Purpose	33
11.13.2	Procedure	33
11.13.3	Requirements	33
Figure 1 – Sch	nematics and photos of Cells on Carrier and bare cell test assembly	8
Figure 2 – Rej	presentative samples of CPV systems, where cells and CoCs are	-
deployed		9
Figure 3 – Flo	w chart of qualification tests for bare solar cells	18
Figure 4 – Flo	w chart of qualification tests for CoCs	19
Figure 5 – The	ermal Cycle Diagram for the CoC test and TCO-1	24
Figure 6 – For Annex A, Meth	ce diagram in the bond strength test (taken from IEC 60749-22:2002, nod B)	29
Figure 7 – Mir	imum bond pull limits (normal to die) (taken from IFC 60749-22 2002	_,
Annex A, Meth	nod B)	
Figure 8 – Scł	nematic of the test set up for the die adhesion test	31
Figure 9 – Die from MIL.ST-8	shear strength criteria (minimum force versus die attach area) (taken .83-K)	32
Figure 10 – So IEC 62137-1-2	chematics of the position of the pushing tool (taken from	
Table 1 – Qua	lification tests description for bare solar cells	14
Table 2 – Qua	lification tests description for CoCs	16
Table 3 – The	rmal Cycle Options (TCO) of test 11.5 for CoCs	23
Table 4 – Mini	mum pulling forces. PW (taken from IEC60749-22:2002, Method B)	

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CONCENTRATOR PHOTOVOLTAIC (CPV) SOLAR CELLS AND CELL ON CARRIER (CoC) ASSEMBLIES – QUALIFICATION

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
82/1818/FDIS	82/1834/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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CONCENTRATOR PHOTOVOLTAIC (CPV) SOLAR CELLS AND CELL ON CARRIER (CoC) ASSEMBLIES – QUALIFICATION

1 Scope

This document specifies the minimum requirements for the qualification of concentrator photovoltaic (CPV) cells and Cell on Carrier (CoC) assemblies for incorporation into CPV receivers, modules and systems.

The object of this qualification standard is to determine the optoelectronic, mechanical, thermal, and processing characteristics of CPV cells and CoCs to show that they are capable of withstanding assembly processes and CPV application environments. The qualification tests of this document are designed to demonstrate that cells or CoCs are suitable for typical assembly processes, and when properly assembled, are capable of passing IEC 62108.

This document defines qualification testing for two levels of concentrator photovoltaic device assembly:

a) cell, or bare cell; and

b) cell on carrier (CoC).

NOTE Note that a variety of alternate names are used within the industry, such as solar cell assembly, receiver, etc.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60721-2-1:2013, Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature – Temperature and humidity

IEC 60749-3:2017, Semiconductor devices – Mechanical and climatic test methods – Part 3: External visual examination

IEC 60749-6:2017, Semiconductor devices – Mechanical and climatic test methods – Part 6: Storage at high temperature

IEC 60749-14:2003, Semiconductor devices – Mechanical and climatic test methods – Part 14: Robustness of terminations (lead integrity)

IEC 60749-21:2011, Semiconductor devices – Mechanical and climatic test methods – Part 21: Solderability

IEC 60749-22:2002, Semiconductor devices – Mechanical and climatic test methods – Part 22: Bond strength

IEC 60904-1-1:2017, Photovoltaic devices – Part 1-1: Measurement of current-voltage characteristics of multi-junction photovoltaic (PV) devices

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IEC 61000-4-2:2008, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61193-2:2007, Quality assessment systems – Part 2 selection and use of sampling plans for inspection of electronic components and packages

IEC TS 61836:2016, Solar photovoltaic energy systems – Terms, definitions and symbols

IEC 62108:2016, Concentrator photovoltaic (CPV) modules and assemblies – Design qualification and type approval

IEC 62137-1-2:2007, Surface mounting technology – Environmental and endurance test methods for surface mount solder joint – Part 1-2: Shear strength test

IEC 62670-1:2013, Photovoltaic concentrators (CPV) – Performance testing – Part 1: Standard conditions

IEC TS 62789:2014, Photovoltaic concentrator cell documentation

IEC 63202-2, Photovoltaic cells – Part 2: Electroluminescence image for crystalline silicon solar cells

ECSS-E-ST-20-08C Rev 1, 18 July 2012, Space engineering – Photovoltaic assemblies and components – Part 7.5.8: Coating adherence (CA)

MIL.ST-883-K, Test Method Standard – Microcircuits Method 2019.9 Die shear strength

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61836 and IEC 62108 apply, as well as the following.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1

bare cell

refers to a semiconductor die level. The physical form during a commercial transaction may be a separated solar cell, a diced wafer on tape, or even a processed wafer. The one common denominator is that the qualified configuration is completely unprotected and not ready for interconnection with the rest of a CPV module

Note 1 to entry: For this qualified configuration, the customer is responsible for all integration and assembly.

Note 2 to entry: For some qualification tests, bare cells are mounted on a substrate, heatsink, or other type of carrier (see Figure 1c). This provides mechanical stability, robust electrical contacts, and appropriate thermal management, but it is not considered in the bare solar cell qualification.

3.2 Cell on Carrier CoC

cell bonded and interconnected with a cell carrier, at a minimum (see Figure 1b). This is a relatively small, assembled unit in a relatively complete and rugged package