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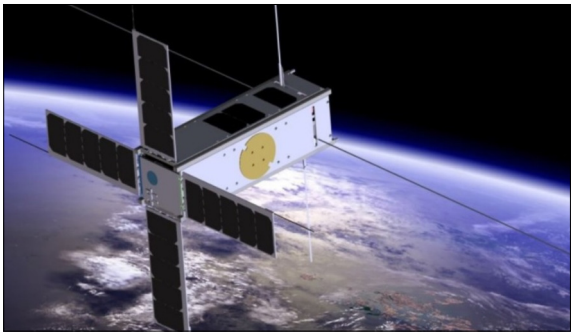
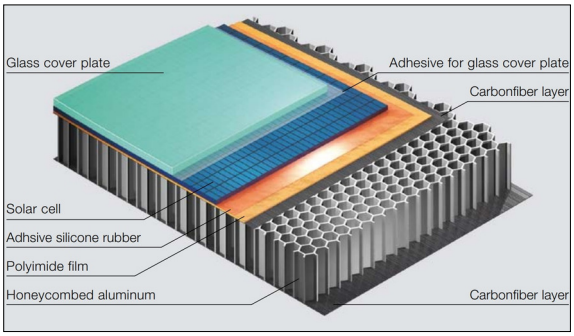
Subject Area	Elektrische Solartechnik (PV, Wind, H2)
Project Partner	RUAG Space, Schaffhauserstrasse 580, ZH

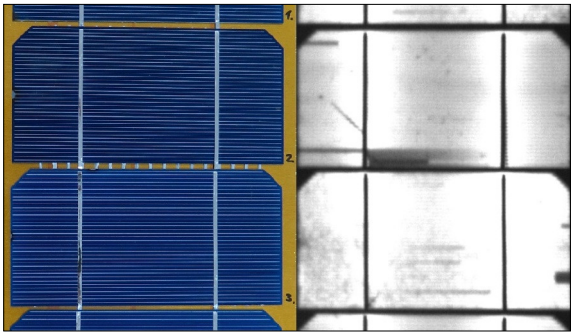
Feasibility study "Solar cell application test for CHESS satellite"



CHESS Satellite as proposed by EPFL Spacecraft Team
EPFL Spacecraft Team - CHESS



Composition of a photovoltaic assembly for space application
Wacker silicones - Adhesives for outer space



Electroluminescence quality check of the breadboard after production, incl. visible damage
Own presentment

Introduction: RUAG Space is currently running a Research & Development project on Solar Arrays to be able to supply their customers with a complete power generating unit. This project is divided into several subprojects, one of them being the development of a “Process for the application of solar cells onto a solar panel substrate”. The first mission, where this process will be verified in space conditions, will be launched in 2023 onboard the CHESS cubesat by EPFL. The panels developed by RUAG will participate in this as a secondary payload. The CHESS project is also an opportunity for several academic institutions to participate on the development of space-grade technology. SPF supports this project with the know-how on photovoltaics and with their technology for testing the reliability and performance of solar cells.
This thesis is the result of research and testing of the newly developed process for the application of solar cells onto a solar panel substrate. During the research phase, existing technologies and materials for this process have been analyzed and the process flow has been proposed. During the testing phase, the process has been carried out, improved, and verified by producing a functional breadboard coupon (a very basic functional model).

Approach / Technology: For testing purposes, identified space-grade components have been exchanged for cheaper but still functional variants for the production of a breadboard which served for the process verification.
Prior to the testing of the process, certain risks have been analyzed and evaluated according to their severity (i.e. damaging of the cells). Secondary purpose of the breadboard production was to mitigate the identified risks and to discover new potential failures threatening the success of this project.
During the research, four breadboards were produced with varying degree of success. The parameters for each of the breadboard differed slightly and the associated issues deepened the know-how of the process and its associated risks. The knowledge gained during this phase laid down a good base for understanding the solar cell application process, but more testing is required to gain enough confidence to carry out the process with space-flight worthy panels. This is partly due to the fact, that no space-grade components were used during the test-production, partly to the fact that not all proposed mitigation actions for potential failures could be successfully implemented.

Conclusion: The current state of the testing campaign is regarded as successful. Risks for the process have been identified and addressed. The process has been verified. All the goals listed in the Scope Statement have been fulfilled. Jigs and tools have been tested and improved. The fact, that no single breadboard was produced without a problem, means that some more improvements have to be done. But these are minor changes to the process and the materials used and don’t influence the proposed process flow. It is believed, that using this thesis as a base document, any further research of this topic will allow for the full implementation of the solar cell application process to the RUAG Space product portfolio.