QCOALA

Quality Control Of Aluminium Laser-welded Assemblies

An idea from

A collaboration between:

LASAG, Precitec, CIT and SAFEL,
Flisom, SolarPro and VW,
Ruhr-Universität Bochum, Fraunhofer ILT and TWI

Technology Engineering

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QCOALA Call & Consortium

- FoF.ICT.2010-10-1 Smart Factories:
  ICT for agile and environmentally friendly manufacturing
- 10 participants from 5 countries
- 40% SME

  laser manufacture, process monitoring, NDT, end-user
- 30% RTD
- 30% LE

  solar energy, automotive

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Objectives of the Project

- To develop a dual-wavelength new laser platform
- Welding of thin-gauge aluminium and copper, 0.1mm to 1.0mm





Technology Engineering

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Objectives of the Project

- Integrated process monitoring and in-line non-destructive inspection
- Reliable, high speed, low-cost and high-quality joining solution
- Electric car battery and thin-film photovoltaic (PV) cell interconnections

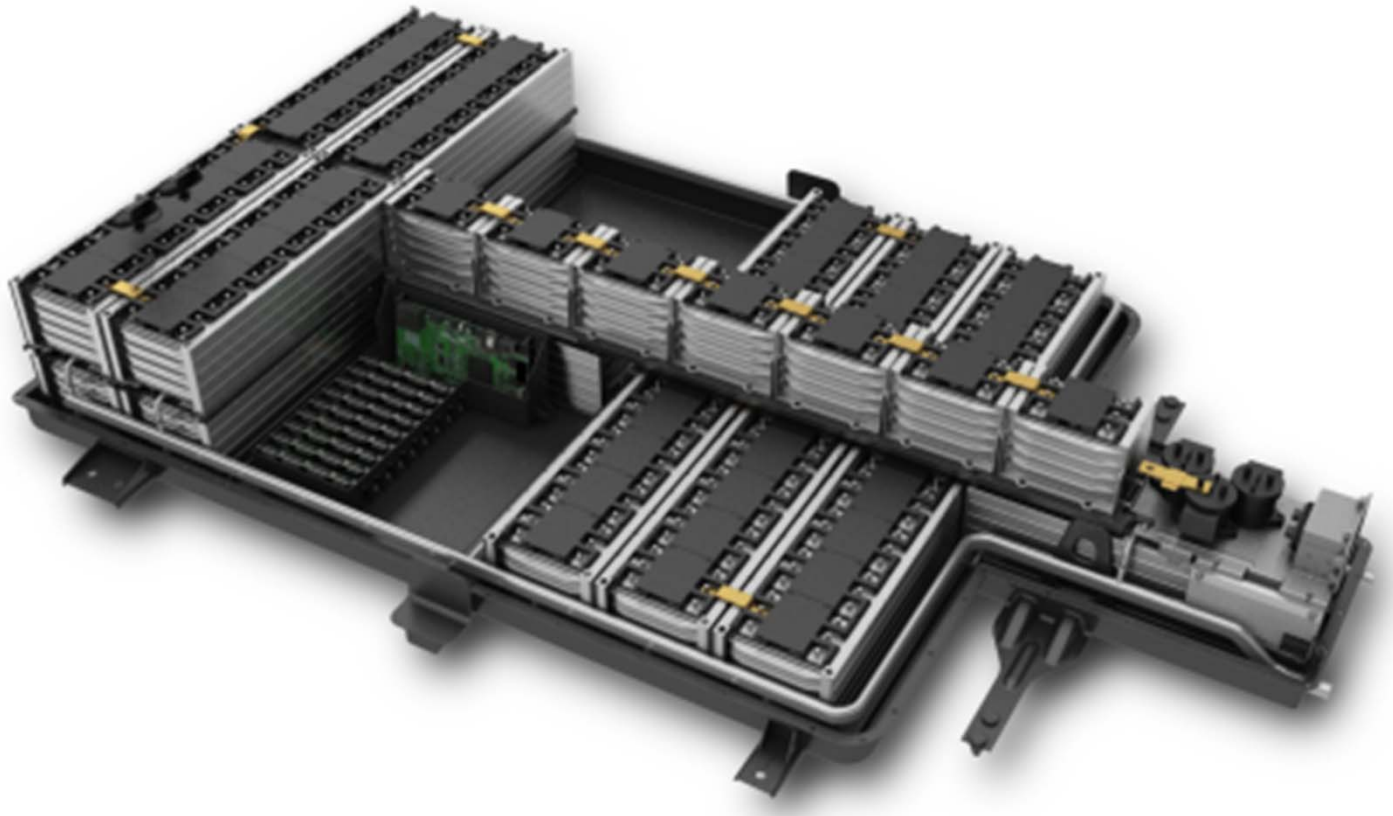
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Industry Focus

- Electric Vehicles (EVs) and Hybrid Electric Vehicles (HEVs) are growing rapidly.
- Current joining techniques, which are considered too slow /low quality
- Laser welding offers the advantage of high-speed, low heat input and low-distortion compared with the more conventional resistance spot or TIG welding process.

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Automotive Application



Courtesy of Volkswagen (automotive end-user in QCOALA)

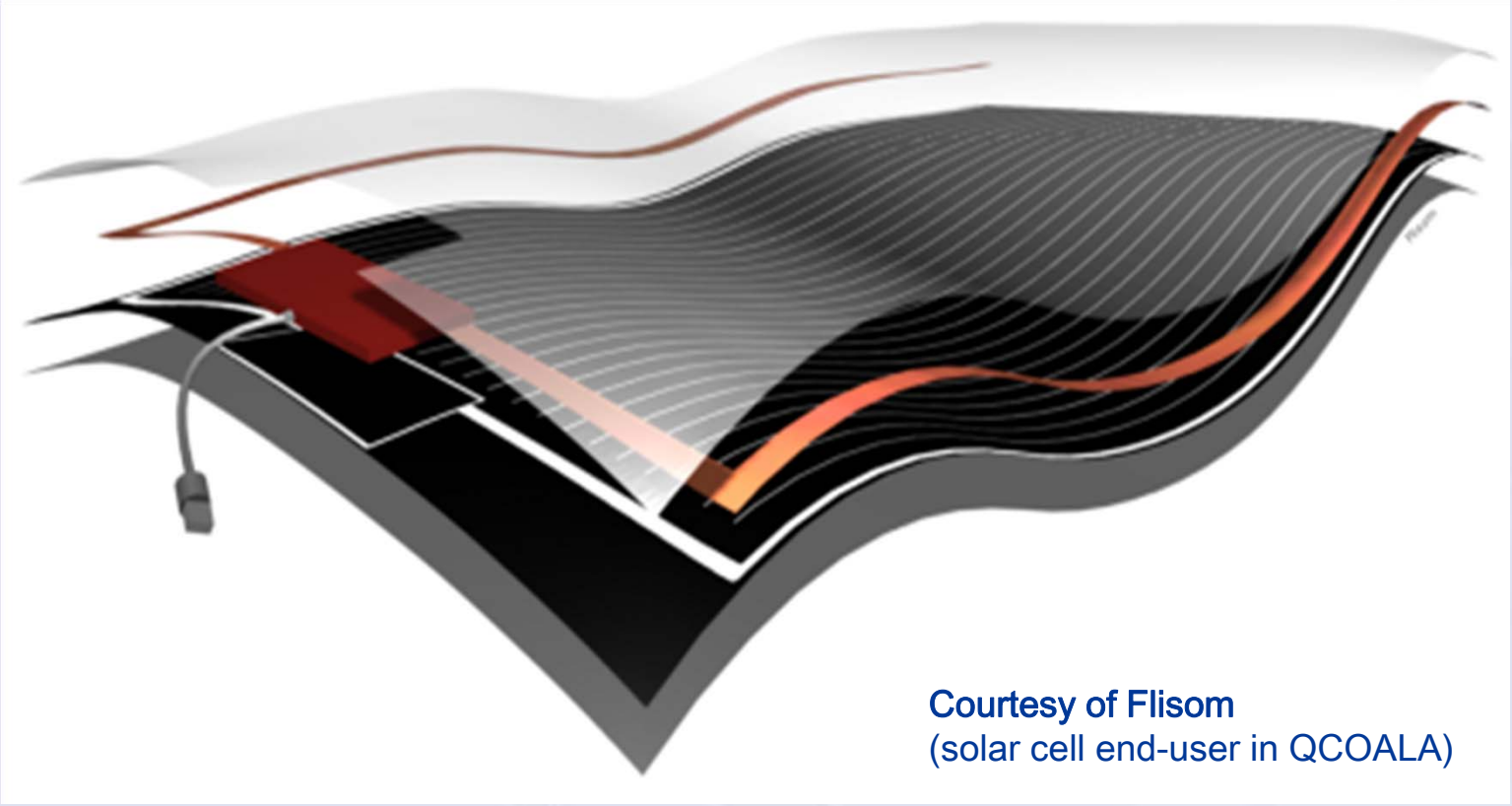
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Industry Focus

- Flexible organic and inorganic solar cells are increasingly becoming important as an alternative source of energy.
- An outstanding question is how to interconnect the individual cells.
- Flexible metal tabs or foils, generally made of aluminium or copper, are connected to the cells to form modules using a conductive adhesive.
- The adhesive presents durability issues.
- Laser welding offers the advantage of a low chemical, thermal and mechanical impact (due to its temporally and spatially selective energy input) compared with ultrasonic welding and it is more durable than conductive adhesives.

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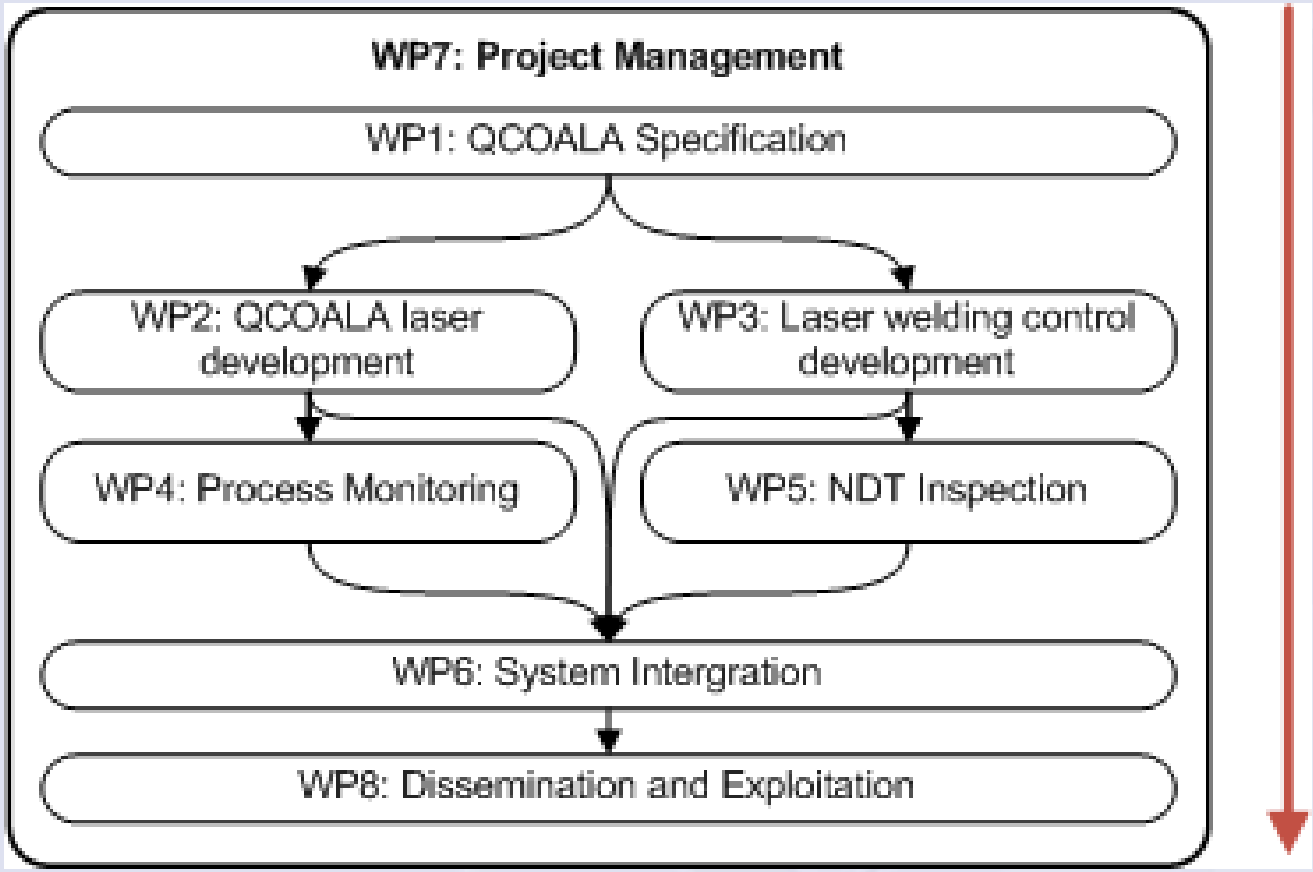
Solar Cell - Photovoltaic



Courtesy of Flisom
(solar cell end-user in QCOALA)

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QCOALA Structure



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Technical Progress

- Delivered a processing window and welding strategy for high-quality laser welding of thin-film PV cell interconnections using fixed and scanning optics.
- Achieved successful process parameters for the battery application in terms of weld penetration depths (greater than 1mm) and welding speeds (up to 6m/min) in Cu C101 material.
- A dual wavelength (GreenMix) laser system (532nm and 1064nm wavelengths) has been developed and commercialised.

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Technical Progress

- Delivered finalised plan for the weld monitoring system (WMS) for PV and battery applications.
- Delivered a finalised plan for the eddy current (EC) inspection system.
- Delivered a finalised plan for the digital radiography (DR) inspection system.

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GreenMix Dual Wavelength Laser System

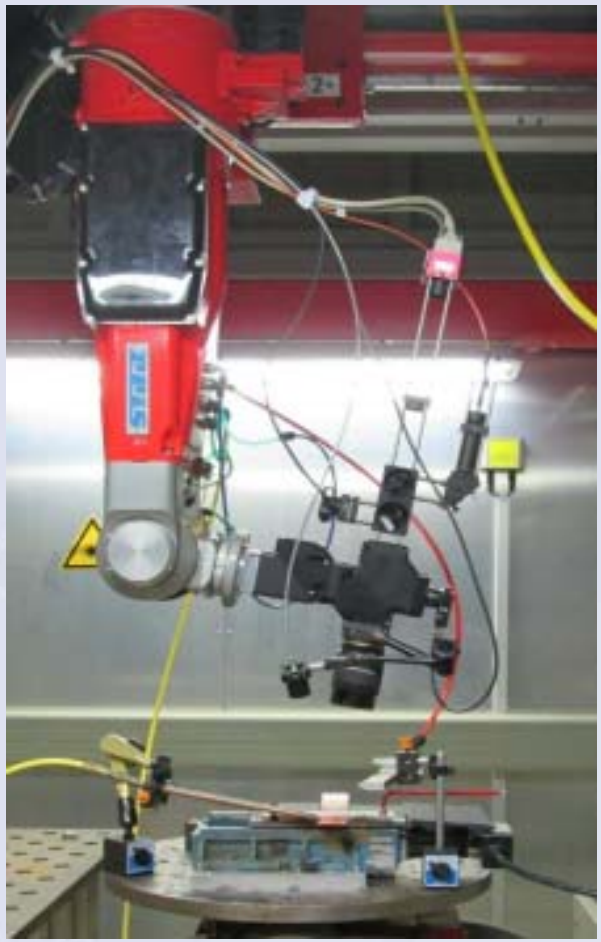


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In-line Inspection Technologies

Weld Monitoring System (WMS) during welding:

- Weld pool geometry detection.
- Weld imperfections.
- Penetration, weld geometry and process emissions.

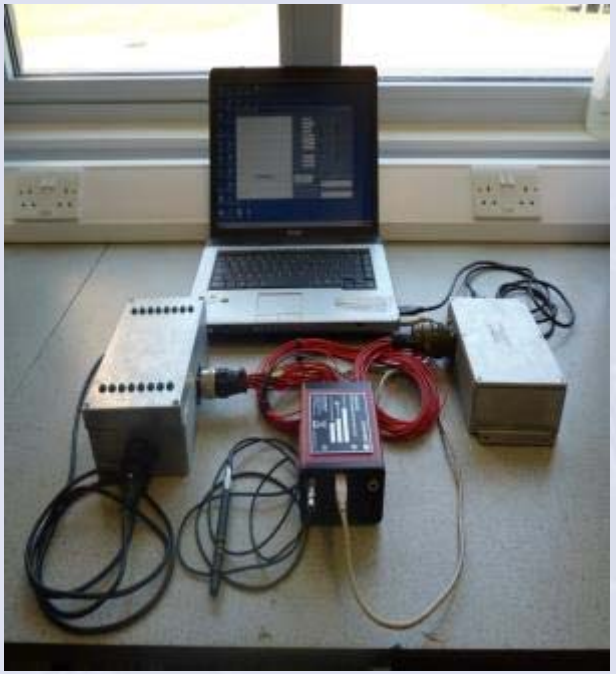


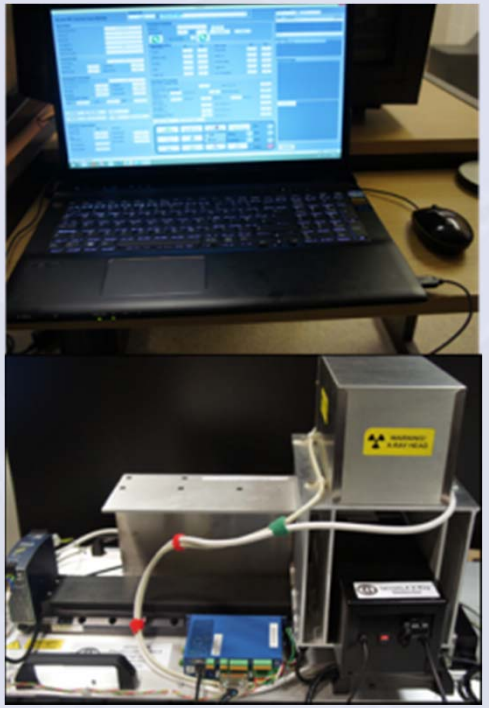
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In-line Inspection Technologies

Eddy Current (EC) and Digital Radiography (DR) systems for post weld:

- Lack of fusion/penetration.
- Porosity.
- Cracking.





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Demo - Solar cell application

- Scheduled in December 2013
- Evaluate the performance of the integrated GreenMix laser platform,
- WMS and DR systems, in line with a real production environment setup
- High-quality welding of thin-film PV cell interconnections
- Compare with current conventional joining technology.

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Demo - Battery application

- Scheduled in July 2014
- To evaluate the performance of an integrated hybrid, pulsed-continuous wave (CW) laser platform,
- WMS, DR and EC systems on real electrical battery terminals
- Compare with current joining technologies.

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Expected Impact

- Advanced automation in small-scale
- Higher productivity and highly customised manufacturing
- Reduced emissions and waste.
- Context-aware, fault-tolerant, adaptable, reconfigurable, interoperable, wireless and robust ICT
- Development of European market for electronic and photonic devices, control and new assistive automation and robot systems

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Thank you!

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