

The Newsletter of Innoval Technology Ltd

CONSULTANCY AND TECHNICAL SUPPORT TO THE ALUMINIUM INDUSTRY

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Delivering Sustainability

"Sustainable aluminium at the heart of a stronger and brighter tomorrow" is Innoval's Vision. More and more of our work has an environmental focus as our clients strive to achieve sustainability targets and play their part in reducing global warming. With the COP26 summit in Glasgow recently ending and the commitments made by Governments there, the time has come for every one of us to do our part to deliver on those commitments.



More and more of our work has an environmental focus.

Innoval has long been an advocate of sustainability initiatives through our work on technology development for closed loop recycling in automotive, automotive lightweighting, and enhanced battery box design, to name just a few. We are also proud to be part of Danieli Group which is committed to working in line with the provisions of the Paris Climate Agreement. Danieli continues to participate in the Corporate Social Responsibility qualification procedure on the Ecovadis platform, having received a Silver rating in 2020 and a ranking better than 79% of the companies surveyed. This is an improvement on the previous year and further targets have been defined for the coming year. The future is both challenging and exciting. We will see more implementation of advanced scrap sorting technologies and plans for exploitation of Green Hydrogen in industrial applications. Innoval is now active in Life Cycle Assessment, and we've recently combined both these activities in a large feasibility study for the packaging sector.

Although much can be done with scrap sorting technologies, there is also the need to Design for Recycling. Many of the manufacturing methods and alloys that are utilised in the major sheet applications, such as beverage cans and automotive, were selected when there was less emphasis on recycling and sustainability. Would those same methods and alloy choices be made today? What can be done to re-engineer those products to reduce their carbon burden? I'm sure we will hear more of this in the coming years.

This sustainability focus crosses sectors and supply chains. In this edition of 'innform' you'll read about how we've supported, through knowledge transfer, a Tier 1 supplier in the automotive sector move to aluminium components, alongside a collaborative research project to design innovative battery boxes for electric vehicles. On the packaging side, we've seen our analytical work increase as end-users move away from single-use plastics to aluminium packaging. Again, we've been involved in ground-breaking collaborative development work here too.

Sustainability is important to us at Innoval, and we're happy we can use our expertise to contribute to one of the most important issues of our generation.

I would like to wish you and your families a happy and healthy 2022.



Dr Gary Mahon, Managing Director, Innoval Technology Ltd.

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Cooperation and teamwork Gestamp delivers an ambitious training programme at Gestamp

In May 2021 we delivered a bespoke online training course on 'Aluminium Automotive Products' for Gestamp employees across the globe. Almost two years in the making, and despite the global pandemic, we were able to reach over 230 delegates in 12 different countries thanks to excellent teamwork and cooperation between our two companies.

With a presence in more than 24 countries. Gestamp is an international group dedicated to the design, development and manufacture of automotive components. The Group specialises in developing innovatively designed products to achieve increasingly safer and lighter vehicles, thereby reducing energy consumption and environmental impact.

Aluminium components

In line with many Tier 1 automotive suppliers, Gestamp is producing an increasing number of aluminium components in response to the automotive OEMs' drive to produce lighter vehicles. This stems from the need to reduce fuel consumption, and therefore carbon emissions, from fossil fuel-powered vehicles, as well as allowing electric vehicles to accommodate heavy battery packs without compromising vehicle range. Innoval and Gestamp first started to work together on the UKRI / Innovate UK funded 'RACEForm' collaborative R&D programme in 2018. Since then, we've gone on to form a valuable partnership.

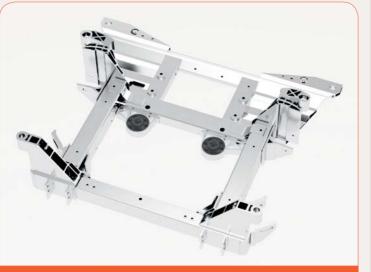


"Gestamp diversified into Aluminium chassis over 7 years ago with extensive internal research projects aimed at developing aluminium design and manufacturing capabilities aligned with existing steel core competencies. A fully integrated global approach was adopted with key personnel from Gestamp in Spain, Germany, China and the UK working together with additional contributions from Engineers in North and South America and Japan. Independent micro analysis of weld joint and parent material coupons by Innoval with expert advice on aluminum composition, process and cleaning requirements, underpinned Gestamp's existing technical & industrial knowledge allowing us to continue to support the rising demand for lightweight chassis structures."

Phil Potter, Global Innovation Project Manager, Gestamp Chassis.



Jaguar I-Pace rear chassis fabrication consisting of aluminium extrusions, hydroformed tubes & pressings with fusion welding.



Jaguar I-Pace front chassis fabrication made from aluminium extrusions with fusion welding.

3-Day training programme

Gestamp sees employee training and development as vital to their position as global leaders in the automotive supply chain. As such, in 2019 Gestamp's Corporate University Manager, Marta Urdiain, approached Innoval to develop a comprehensive training programme that would give the company's engineers and non-technical support staff an excellent grounding in aluminium technology as part of their aluminium roadmap.

The brief was to produce a 3-day training programme, the first day of which would introduce aluminium (some basic metallurgy and alloy and temper designations); and give an overview of processing techniques (rolling, extrusion, casting, stamping and joining). The first day would be for everyone. The subsequent two days were to be exclusively for engineers and those employed in a technical discipline. Gestamp wanted us to explore in more depth the topics from Day 1, as well as introduce some new ones, including Surface Treatment and Welding. Once we agreed the course outline, we set about developing the material.

Over the course of several months we worked closely with the Gestamp Chassis team to produce a training course that would be relevant to the products and processes within Gestamp. Where possible, we incorporated examples of both within the training, thanks to the many examples provided by Gestamp. Overall, we wrote material for 14 modules, the majority of which were 1.5 hours long.

Pilot event in Bilbao



"We aim to provide world class training to support Gestamp's strategic objectives, keeping up with the latest technologies and materials in order to continually evolve. A main pillar of the Corporate University philosophy is to share the knowledge acquired through experts' expositions and interactions with champions of use of aluminium, so the Group may apply them in the best possible way. Innoval makes the perfect partner to do so, whilst promoting and laying the basis for a standardized use of the material."

Marta Urdiain, Corporate University Manager, Gestamp.

During 2021 we have further consolidated our relationship by providing detailed micro-structural investigation and analysis work on a number of different Gestamp research projects.

We are looking forward to further developing our partnership and continuing to support Gestamp's goals of developing and providing products that offer high value in terms of innovation, price, quality, safety and environmental impact.

If you'd like to explore training opportunities with us, please contact our Training Manager at helen.forrest@innovaltec.com



Aluminium automotive structures developed by Gestamp.

At the end of February 2020, once the materials were almost finished, Gestamp invited us to Gestamp Technology Institute (GTI), their impressive training and R&D facility in Bilbao, Spain, to run a pilot event. We presented the course to a group of Engineers from across the various technical disciplines within the company. There was a lot of discussion resulting in some excellent feedback, which allowed us to refine the materials.

Originally, we were hoping to deliver the course over 3 days in Bilbao. However, shortly after the pilot event, the pandemic hit us all and the project was put on hold. Eventually, thanks to some careful organisation by the GTI team, we delivered the course via a series of 2-hour online sessions twice per day (to accommodate different time zones), every day for three-weeks. This was complemented by Mike Bell, Senior Development Engineer, from Gestamp presenting the welding focussed module. It was a huge undertaking but, thankfully, one which paid off. The feedback from Gestamp delegates was exceptional.

Al-ULEV Project; innovative designs for EV battery enclosures

Currently there is a lot of development work focused on the design of aluminium battery enclosures for electric vehicles. One such project, which concluded recently, was Aluminium for Ultra Low Emission Vehicles (AI-ULEV). This Innovate UK-funded project was one of the many collaborative research projects that we've worked on over the last 18 years.

The energy requirement (Wh/kg) for the driving range of an electric vehicle is strongly linked to its curb weight. Therefore, reducing the vehicle weight will increase the range for a given battery pack. The battery pack is a significant contributor to the overall weight of the vehicle.

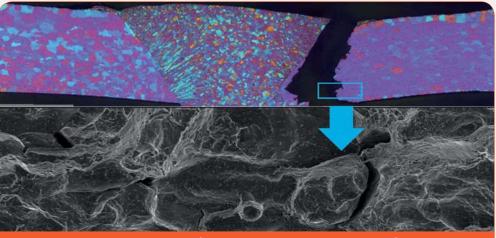
Why aluminium?

Aluminium is well known for its favourable strength to weight ratio. It can deliver considerable light-weighting compared to steel in automotive applications, including battery enclosures. However, a particular challenge is to find solutions for battery enclosures that are manufacturable in a timely and cost-effective manner. The Al-ULEV project focused on the development of prototype battery enclosures and vehicle integration systems using predominantly extruded components.

The project consortium which we were part of consisted of Constellium, Gordon Murray Design (GMD) and Brunel University (BCAST), London.



Prototype production



Microstructural analysis of a test joint (carried out by Innoval as part of the project) shows the weld failing along grain boundaries at the edge of the joint. This prompted the team to re-evaluate and improve the welding parameters.

The project produced and crash-tested two innovative prototype battery enclosures. The first was designed to fit within GMD's technology portfolio (iStream[®], iFrame[®], etc). The second was a lightweight optimisation of a current OEM battery enclosure.

Innoval played an integral role in the development of the prototype enclosures by:

- Creating a fully flexible cost model to highlight the financial impact of changes to the battery enclosure design and the applied joining technologies
- Conducting Life Cycle Assessment (LCA) to highlight the environmental impact of battery enclosure manufacturing
- Employing our UKAS-accredited laboratories and in-house materials characterisation experts to assess the novel joining methodologies proposed by the project
- Using bespoke experiments to investigate the impact of aluminium composition and surface quality on joint integrity across a range of joining techniques
- Designing testing and measuring equipment for quality and dimensional control of battery enclosures



Schematic of a battery housing (image from Constellium).

Both prototypes utilised bespoke extrusion designs to provide thermally efficient profiles that would be able to extend battery life, improve battery performance and enhance safety. This, in turn, has a direct impact on the energy density and power density of the battery pack and, therefore, the range of the vehicle between charges.

The advances from the AI-ULEV project will help OEM's to achieve their vehicle and battery weight reduction and performance targets. Furthermore, they will allow the manufacture of lighter, safer vehicles with zero emissions at lower cost.

Drinking it all in; how we support the beverage can industry

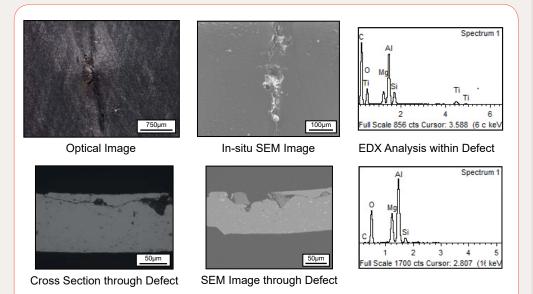
If you were to visit our offices and labs in Banbury, you'd probably be a little shocked at the number of beverage cans, in various states of destruction, around our laboratories. The last 18 months have seen us very busy with work from our clients in the packaging sector which, recently, has kept our Materials team fully occupied with experimental work.

Increased production

Over the last few years sustainability concerns have prompted a move away from plastic packaging by many consumer goods companies. Often, and especially in the case of beverages, the alternative material has been aluminium. Add to this the boom in home consumption and multi-pack beverage cans caused by the COVID-19 pandemic, and you can see why beverage can production has sky-rocketed. There has even been the much publicised can shortage or 'candemic' in the US.

Who we work with

Our work within the beverage can sector is varied. We count many of the major can manufacturers, as well as many can fillers, as our clients. Furthermore, during the last year we have been involved in two



We use multiple analytical techniques to get to the bottom of quality problems like pin holes in a beverage can.

Innovate-UK funded collaborative research projects involving beverage cans (Torch 2 and BACpack).

Analytical expertise

In the majority of cases our support takes the form of trouble shooting. We help our clients get to the bottom of common problems such as leaking cans, 'popped' ends, split flanges and rim staining. Often there can be several causes to a problem and it's our job to work out which one it is. For example, leaking cans can be caused by pin hole defects, can-making defects or under-film corrosion to name a few.

Our investigative work involves a combination of state-of-the-art analytical equipment and decades of product experience. The images above give an example of how we use a combination of optical microscopy, scanning electron microscopy (SEM) and Energy Dispersive X-Ray Analysis (EDX) to analyse pin holes in a can.

New training course

Drawing on both our product and process expertise, we have developed a new training course for our rolling mill clients who are considering making can sheet. The course is called '**Beverage Cans and Can Sheet**', and we delivered it remotely earlier this year to one particular client. Over the course of 4 half-day sessions we gave an overview of the can-making process and can sheet metallurgy, as well as focusing on hot and cold rolling of can sheet, lubrication in beverage can manufacture and, finally, surface treatment, corrosion and quality requirements. At the end of the 4 sessions, the delegates rated the course highly with one, a Cold Rolling Operations Manager, remarking, "Fantastic course, one of the best I have ever attended."

If you think we can help you either with defect analysis, or you'd like to find out more about our '**Beverage Cans and Can Sheet**' training course, please contact us at enquiries@innovaltec.com



The COVID-19 pandemic has caused a surge in demand for aluminium beverage cans.



What's your carbon footprint?

It is now more important than ever to understand the environmental impact of your product or service. This is because environmental impact is increasingly in the public's consciousness, as well as the political arena. Furthermore, this focus on sustainability is coming from investors as well as consumers. This is where Life Cycle Assessment (LCA) comes in, and it's a service we now offer at Innoval.

Life Cycle Assessment

Life Cycle Assessment (LCA) is a methodology to assess the environmental impact of a product or service by the compilation and evaluation of inputs, processes and outputs of a product system. The product system can include the making of the primary materials and further processing of the product. It can also include transport, waste streams, the use phase, end of life (EoL) etc. Boundaries detailing what will be in and out of scope define the product system.



environmental impact of your product or service

The stages of an LCA study



LCA can study an entire process from beginning to end which we refer to as 'Cradle to Grave'. It can look at the making of the product, which we call 'Cradle to Gate'. Finally, it can consider a particular process in isolation, which we call a 'Gate to Gate' study.

LCA uses structured and standardised methods such as ISO 14040 and ISO 14044. However, despite this, you should only compare products and processes examined within the same study because there are many intricacies within LCA. Furthermore, an external reviewer would need to assess a comparative study to ensure the report and comparison are non-biased.

The LCA process typically has four stages. These are Goal and Scope definition, Life Cycle Inventory Analysis (LCI), Life Cycle Impact Assessment (LCIA) and Life Cycle Interpretation and Reporting.

Input quality

Like most studies, the validity of the final result depends on the quality of the inputs. Therefore, when conducting an LCA, it's important to make sure you capture all the relevant processes. For a product which incorporates aluminium, this is where we excel. Our specialist aluminium industry knowledge, combined with the latest Life Cycle Assessment software (GaBi), means we're perfectly placed to offer reliable and independent Life Cycle Assessments to the aluminium industry.

If you'd like to find out more about our LCA service, please contact us at enquiries@innovaltec.com

More News... More News... More News...

Our Rolling Course is back in Banbury!



We're very excited to announce that our next Aluminium Rolling Technology Course will be held in Banbury once again. This means, as well as a full week of lectures. our delegates will also enjoy a packed social programme which includes a tour of Jaguar Land

Rover's impressive manufacturing facility at Castle Bromwich. Subject to COVID-related travel restrictions, the next course will take place on 14-18th February 2022. Please contact us for details of our early-bird pricing offers. Photo credit: Jaguar Land Rover

Online courses to watch out for in Spring 22



We're planning to keep our shorter courses online. There will be two available for registration in the

Spring; 'Introduction to Aluminium Metallurgy' and 'Aluminium Surfaces & Coatings'. If you'd like to be notified of the dates as soon as they become available, please send a message to enquiries@innovaltec.com