

Reflecting on 10 successful years

2013 has been a year of celebration and growth for Innoval Technology. In May we celebrated our tenth anniversary which gave us chance to contemplate everything we've achieved over the last decade.

Many of you will be aware that Innoval Technology was formed following the closure of Alcan's Banbury Laboratory in 2003. Since then, the company has grown year on year and we now have almost 350 clients. We've worked hard over the last decade to develop an extensive product portfolio which includes a suite of process models for aluminium rolling, specific support for strategic industry investments and the successful Aluminium Rolling Technology Course, which is about to enter its ninth year. We have also worked on many cutting-edge aluminium research projects funded by the UK Government, and some of these will lead to the formation of an exciting new aluminium casting research centre at Brunel University in London.

we're actively recruiting new engineers and metallurgists to join our team of specialists. Over the last year we've welcomed two new members to our Process Improvement Team, James Buffham and Timothy Clemson, and we will continue to recruit more staff next year.

2014 will see us move into our second year as part of Danieli's Aluminium Division. It's been a busy time for us as we've been supporting some very large mill projects. The 6-high Diamond Mill at Aleris in Duffel, Belgium, produced its first coil only 19 months after order placement. Further orders from AMAG in Austria (hot rolling mill and plate stretcher) and KUMZ in Russia (double stand hot rolling mill and the world's widest 6-high Diamond cold mill) will be delivered in 2014. Furthermore, Alcoa has recently chosen Danieli for the revamp of its cold rolling mill in Samara, Russia.

In October we were delighted to be part of the first Danieli Aluminium Technology Forum which was a very successful event held at Danieli HQ in Buttrio, Italy. The broad range of aluminium equipment offered by Danieli was introduced to a large global audience of aluminium companies.



Tom Farley cuts Innoval's birthday cake

We intend to build on the last ten years with a strong growth strategy and

One of the 'hot topics' at the Danieli Forum was the supply of aluminium



The Innoval team enjoying a celebration lunch

automotive sheet. Automotive producers are increasingly moving towards more aluminium-intensive vehicles in order to meet CO₂ emissions targets and the resulting prediction of growth in the aluminium automotive sheet market is very exciting. Much of the automotive sheet technology being adopted was developed by Innoval staff when they worked for Alcan in Banbury, and so we have a deep understanding of the rolling and finishing operations required to make this product at the required level of quality. We are looking forward to providing technical support to any suppliers wishing to enter this market.

I hope you have a successful 2014.

Dr Tom Farley
Managing Director, Innoval Technology Ltd

Inside this issue...

A Multi-disciplinary Approach at Aluar	page 2	Your Mill Performance vs World Class	page 3
A New Model for our Rolling Process Toolkit	page 2	High precision tear testing of aluminium alloys	page 4

A Multi-disciplinary Approach at Aluar



Exit of cut-to-length line at Aluar

to implement their ideas to improve productivity, yield and product quality. A rigorous approach to defect classification was established in order to accurately identify the reasons for scrap generation and so begin to improve recovery. Statistical Process Control, with highly visible performance measures, was introduced and the teams were taught effective problem solving techniques. Further improvement ideas were generated around the design and maintenance of the hot mill and its cooling system, part of which included a cooling analysis using Innoval's spray modelling capabilities. Aluar personnel have continued to develop the process and implement improvements.

Aluar Aluminio Argentino S.A.I.C. (Aluar) is the only primary aluminium producer in Argentina. In addition to a large business in ingot and extrusion billet, the smelter also supplies Aluar's rolling operations at Abasto.

Aluar's rolling facilities include a hot reversing mill, a cold mill and three foil mills. Because our Process Engineering team has experience of world-class rolling operations, the team at Aluar contacted us to help them improve quality and productivity with a view to increasing their market share.

During the first visit to Abasto, Dan Miller and Kyle Smith audited the rolling operations and analysed the material flow and material storage. They made assessments of the standards achieved against operations with similar equipment and against world class standards. From this they identified opportunities for improvement, and they worked closely with the team at Aluar to prioritise



Profile measurement



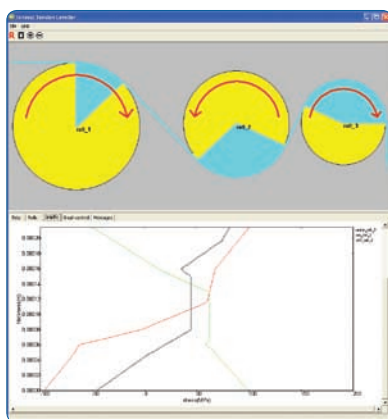
Mill control pulpit at Aluar

We've been delighted to continue working with Aluar by providing several strategic studies. These have included a study on the benefits of alloy optimisation from our Materials Development team, lead by Gary Mahon, as well as looking at the strategic investments necessary to expand the hot rolling capacity in the longer term.

One of the Aluar team had this to say about working with Innoval:

"It is a pleasure to interact with people like Dan, Kyle and Gary. They are very professional in their approach yet open and friendly, so it's easy to build a rapport with them. We value the interactions we have with different Innoval consultants as they help us to identify new issues and plan for the future. We value their comprehensive range of skills and extensive industry experience, and can rely on them to give us sound independent advice."

A New Model for our Rolling Process Toolkit



In this screen shot the curves shown are the stresses across the third of the leveller rolls. They show the strip coming onto the roll (blue), when the strip is on the roll (red) and as it comes off the roll (green).

In previous editions of 'innform' we've introduced our suite of rolling process models. In this issue we're pleased to reveal the latest addition to the toolkit: the Innoval Tension Leveller model.

This model allows the user to bring the strip into the leveller and adjust the settings across the leveller rolls to get optimised strip exit flatness. As the strip passes over each roll, the stresses and strain in the sheet are calculated to give the strip curvature after each roll.

Once information about the strip (gauge, entry tension, exit angle, stress strain curve for the alloy) and the rolls (geometry, rotation direction and tension) has been entered, the predictions are shown in both table format and graphically within seconds.

A selection of stress, yield stress and strain for any roll can be plotted as a function of thickness. Tabular results include the strip tension after each roll, the average yield stress, total strain, plastic strain, curvature and friction.

Like all of our process models, the Innoval Tension Leveller model is available for use under a license agreement.

If you'd like more information about the Innoval Tension Leveller model, please contact Dr Rade Ognjanovic at rade.ognjanovic@innovaltec.com

Your Mill Performance vs World Class

One of the services offered by the Innoval team is performance benchmarking. Our clients find it useful to know how their mill performance compares to world class standards. Here we give you a very brief overview of some of the things we assess when making comparisons between rolling mills.

Step 1: Questionnaire

In order to compare a client's mill with similar ones, it is necessary to make sure that the mill dimensions and capabilities are similar. A product based questionnaire, which details the most important process information affecting productivity, is completed by the client for each key product type and gauge range.

Step 2: Plants

To get an insight into how the client's performance compares with its peers, anonymous data from plants with similar equipment and technical competence are selected for comparison, the best known performance is highlighted and the client's mill ranked for each product class. Together with this, a set of plants operating different product mixes and with different mill capabilities is selected in order to provide a broad view of how the client's mill performs when compared with the general industry.

Step 3: Parameters

The following example is for the assessment of a foil rolling operation.

3.1 Mill speeds

Three passes are used to compare foil mill speeds:

Antepenultimate Pass (m/min)

This pass is normally performed as the last pass of roughing mills or the first pass of foil finishing mills. It is usually the first truly closed gap pass and the one which gives the highest mill speed if the reduction schedule and roughness are well chosen.

Penultimate Pass (m/min)

This is typically the pass where foil plants try to make the maximum speed. Achieving and maintaining speeds coil after coil is key to productivity.

Last Pass (m/min)

Speed in this pass is normally constrained by surface finish quality and to avoid strip breaks, with top performers being able to optimise roll finishes and reductions.

3.2 Mill speed utilisation (%)

The use of the maximum capability of the mill speed gives an indication of the current gap between the machine design potential and the actual speeds used.

3.3 Coil change time (seconds)

Coil change comparisons are difficult to perform as different mills have critical design features which affects the time. In order to make a comparison, similar size mills from the same manufacturer as the client's mill are selected.

3.4 Mill width utilisation (%)

The most powerful productivity factor for a mill is how much of the maximum available rolling width is used. At the same time it

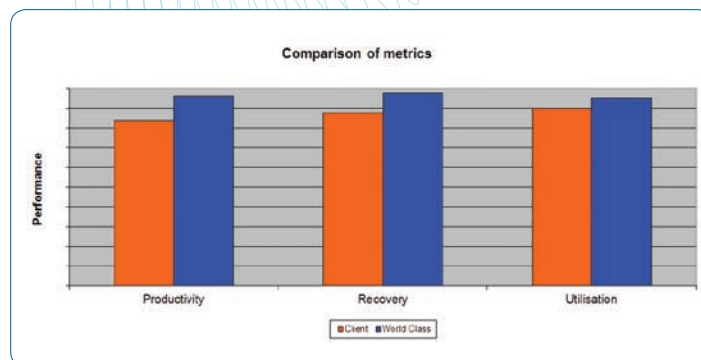


Coil storage at Impol, Slovenia

can be the most difficult to modify as it depends on the type of orders available in the market and the profitability of the different customers' widths and availability of other rolling lines.

3.5 Utilisation (% time)

Although it is difficult to draw a comparison between mills of different ages and with a different product mix, we try to find a machine that's comparable to check time distributions. We look at metrics such as rolling time and the time taken for machine breakdowns, roll changes, coil changes and preventative maintenance.



Charts similar to this one are created for the various parameters (real data has not been used).

"We used Innoval to carry out a mill benchmarking exercise for us because we value their objectivity and global industry knowledge. Following the study we now know how we perform relative to our competitors and where we need to improve."

**Tomaz Smolar, Director, Rolled Products,
Impol Aluminium Industri, Slovenia.**

impol
Aluminium Industry

For more information about our process support services please contact Dr. Tom Farley at tom.farley@Innovaltec.com



High precision tear testing of aluminium alloys

Many of you will be familiar with the Kahn tear test which is used to determine initiation and propagation energies of a material as it is plastically deformed in the presence of a sharp notch. The test measures a combination of a material's strength and ductility, both of which contribute to resisting crack growth under either elastic or plastic stresses.

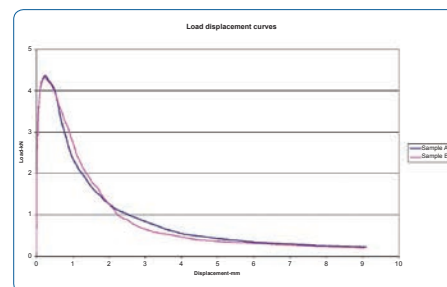
The basic 'Kahn' tear test is covered by ASTM B871. Initiation energy is defined as the area up to peak load on the load extension curve and propagation energy as the area post peak load (shown in the graph). Historically the test has been complicated by the apparatus, necessitating the use of an un-notched sample as well as the notched test piece.

In conjunction with WMG at Warwick University, we have been able to significantly update and improve the basic 'Kahn' tear test. Using the university's GOM Aramis 2D full field non-contact strain measurement equipment, we've developed a method which measures deformation directly on the specimen surface in the notch region. The new method does not require an un-notched sample to be tested. In addition to this, every test has a digital image record of the tear initiating and propagating through the sample. This provides valuable information on, for example, tear deviation which may be associated with extrusion defects.

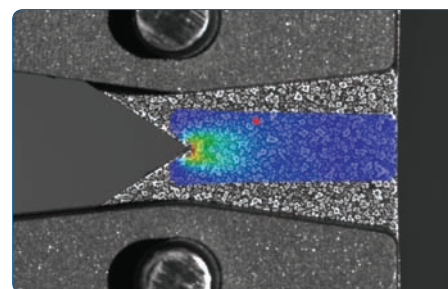
If you'd like more information about our fracture toughness testing service please contact Richard Keyte at richard.keyte@innovaltec.com



Test apparatus



Synchronous load data is taken from the test frame. Displacements are calculated from surface strain measurements in the notch region. Energies can then be calculated from areas under the curve.



Surface deformation as sample undergoes early stages of loading

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

Exciting news for Automotive Light Metals Research

Thanks to an unprecedented grant of £4.4M (Euro 5.1M) from the UK's Engineering and Physical Sciences Research Council (EPSRC) a national scale-up facility for light metals research will be created in the UK.

The Advanced Metal Casting Centre (AMCC) will be situated at Brunel University in London which has allocated a further £2.5M (Euro 2.9M) for a dedicated building and project support.

The purpose of the new facility, which will be managed through collaboration between Brunel University, Constellium and Jaguar Land Rover, will be to bridge the gap between fundamental research and industrial applications. Through our links with Brunel University, Innoval Technology will have full access to the AMCC for research and development projects.

For more information please contact Prof. Geoff Scamans at geoff.scamans@innovaltec.com



Crash management system from Constellium

Introducing our new recruits



Timothy Clemson

Timothy Clemson joins us having recently completed his Physics PhD, following a degree in Theoretical Physics. We welcome him to our Process Improvement team where he works on the modelling of aluminium rolling and finishing processes.

James Buffham, who graduated in Engineering Science from Oxford University in 2012, has joined our Process Improvement team to support the application of our process models.



James Buffham