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JW:lf
7 August 2015

Anti-Dumping Commission

Bluescope Ltd - Application for an Anti-Circumvention Inquiry into Zinc Coated (Galvanised) Steel Exported from the Republic of Korea and Taiwan

I act on behalf of Wright Steel Sales Pty Ltd, a company that has been identified in the abovementioned application by BlueScope Limited (BSL) and also act for CITIC Australia Commodity Trading Pty Ltd, which has received an Importer Questionnaire in relation to this investigation. This preliminary revised submission deals with the inadequacies in the BSL application and the reasons why the investigation should be terminated forthwith.

BSL admissions, inconsistent applications re Taiwan, and WTO compliance

There are a number of reasons why BSL fails to meet the minimum requirements that must apply to any WTO compliant system. BSL seeks the imposition of measures from the date of notification of this investigation, without any analysis of current normal value, export price, injury factors or causation. That is particularly problematic in this instance, given that in a separate application dated May 2014, seeking dumping duties on Galvanised Steel from India and Vietnam, BSL has admitted that after the successful anti-dumping application against exports from PRC, Korea and Taiwan, "(e)xports from Taiwan have continued, albeit at levels that are understood to be non-dumped" (p33). Thus BSL is separately admitting to ADC that exports from Taiwan are not currently being dumped. Nevertheless, it is seeking to have exports of alloy steel from that source country incorporated into an earlier anti-dumping duty notice via this circumvention allegation. It is simply improper to justify treating what BSL now admits are non-dumped exports as somehow being intended to avoid an anti-dumping duty.

A whole range of problems would flow if this application were accepted. First, Australia would be in breach of its WTO obligations in imposing a measure on goods that the applicant itself admits are non-dumped. ADC cannot do anything other than accept that admission which should be fatal to this application where Taiwan is concerned.

Secondly, there can be no commercial consistency whatever then happened with the enquiry as to India and Vietnam. SEF 249 in that case recommended termination which now appears to have been the final outcome (ADN 2015/93). It would be wholly unrealistic to accept the current market figures in that conclusion and then allow a circumvention case to render all alloy goods from other countries subject to unrealistic historical dumping factors not applicable in the current market. Australia would be treating what BLS asserts to be potentially identical imports from different sources in wholly distinct ways without any commercial justification, in violation of Australia's WTO non-discrimination obligations. The treatment of Korean and Taiwanese products would be non-commercial, prohibitive and discriminatory. This would be so for the following reasons: In the recently concluded inquiry in relation to India and Vietnam, normal values, export prices, injury factors and causation, were considered in the context of a recent period of investigation. Normal values are currently significantly lower than they were at the time of the original investigation that predated this circumvention inquiry, particularly through the decreases in iron ore and coking coal prices, which would in turn allow for lower export prices. The exchange rate is also vastly different. These facts would be obvious to ADC. Including more expensive alloy steels in the earlier investigation via a circumvention case without analysis of dumping and injury, with resultant unrealistically high normal values and ascertained export prices than are commercially attainable, would thus be unfairly discriminatory.

Anti-circumvention regulations should not be used to bypass a required analysis of the key criteria, particular when the applicant concedes that it would not be possible on current evidence to satisfy those criteria. BSL should have included alloy product from Taiwan and Korea in the recent application vis-a-vis India and Vietnam that expressly included alloy product in the goods identified, if it wanted fair treatment of the different sources of alloy supply. ADC should not be expected to make up for BSL's failure to include alloy steel from Korea and Taiwan in either the initial application, or in the latest application re India and Vietnam. Importantly, BLS failed to even show dumping in relation to alloy product from India and Vietnam, yet is in this case alleging circumvention of a supposedly deserved duty in relation to Korea and Taiwan.

While it is not for the Commission to determine whether Australia's anti-circumvention regime is WTO compliant or not, the Commission must obviously act in a way it believes to be compliant in the event that such measures are permitted. In that sense, ADC would be aware that there is no consensus amongst WTO members as to whether such provisions are permitted or not. Importantly, however, even if such measures are permitted, they must be consistent with the WTO Anti-Dumping Agreement (ADA), otherwise Australia would be in breach of its international obligations. In terms of WTO compliance, this is made clear in ADA Arts 1 and 18 and also by cases such as *US-Byrd Amendment* and *US-1916,* which clearly support the proposition that a member can only apply anti-dumping measures when these are consistent with ADA. In the context of this application before ADC, if certain goods not covered by an anti-dumping measure are sought to be included under that measure via a circumvention application, the latter is in fact imposing anti-dumping measures that need to be WTO compliant. It cannot be correct to impose a measure against a source country at a time when the applicant separately admits there is no dumping from that country.

ADA makes clear that before anti-dumping measures can be imposed, an investigation must consider whether goods are being exported to Australia at dumped prices and if so, whether this caused the material injury to like goods. ADA Art 5.2 states that "(a)n application under paragraph 1 shall include evidence of *(a)* dumping, *(b)* injury within the meaning of Article VI of GATT 1994 as interpreted by this Agreement and *(c)* a causal link between the dumped imports and the alleged injury. Simple assertion, unsubstantiated by relevant

evidence, cannot be considered sufficient to meet the requirements of this paragraph." ADA Art 5.8 states that "(a)n application under paragraph 1 shall be rejected and an investigation shall be terminated promptly as soon as the authorities concerned are satisfied that there is not sufficient evidence of either dumping or of injury to justify proceeding with the case". Given BSL's admission re Taiwan, the circumvention investigation in relation to that country should be terminated forthwith.

In addition, ADC should, as a result, review the initial measure as against Taiwan based on BSL's own admission

The BSL admission as to Taiwan and the recent termination in relation to India and Vietnam have other implications. ADA Art 11.1 provides that "(a)n anti-dumping duty shall remain in force only as long as and to the extent necessary to counteract dumping which is causing injury." ADA Art 11.2 provides that "(t)he authorities shall review the need for the continued imposition of the duty, where warranted, on their own initiative or, provided that a reasonable period of time has elapsed since the imposition of the definitive anti-dumping duty, upon request by any interested party which submits positive information substantiating the need for a review."

Given that BSL has admitted that exports from Taiwan are not now dumped and that ADC has found far different normal values and export prices in the gal steel market in Australia in rejecting the claims against India and Vietnam, the grounds exist for a self-determined review by the authorities, which should now proceed. ADC knows that the historical normal values and ascertained export prices are commercially impossible to achieve in the current market climate and will remain unrealistic for the foreseeable future.

The uncertain ambit of the application renders it invalid

In addition to the application being undermined by BSL's own admissions where Taiwan is concerned, the application is inadequate as to all targeted countries as there is no clear and workable indication of the goods to be covered. BSL should not be entitled to make an open-ended application in relation to goods that cannot be identified from the face of the application.

ADA Art 5.2(ii) requires "a complete description of the allegedly dumped product." The anti-circumvention application does not provide any clear parameters as to which alloy goods are covered or not. It is either too broad or too uncertain or both. The application states (page 5) that following the imposition of measures, certain exporters included more than 8 ppm Boron. It goes on to assert that the addition of more than 8 ppm is a simple additive that involves a minor modification and constitutes a circumvention activity. No indication is given as to whether any amount of Boron would be sufficient to constitute a more than minor modification. (Confidential material deleted) the benefits of which are supported by clear and independent scientific studies which should have been known to BLS and its advisers. Indeed a simple web search shows that BLS supports at least one university research centre, whose newsletters announce such findings. One example is attached.

Even more disturbingly, the application states further (page 6) that there may be a slight modification by "the addition of a compound or product (i.e. Boron or Chromium) …". No indication is given as to which if any other compounds might be included and to what degree.

In other places, BLS simply refers to alloy steel, perhaps seeking to include all alloys, no matter the composition. BLS Visit Report notes that it has complained about Boron and "potentially other elements."

BLS needs to state clearly just which product is under investigation for the sake of ADC and all other interested parties. Once it designates coverage, it needs to provide sufficient relevant evidence as to why all claimed instances fall foul of the legislative provisions. Does BLS intend the original notice to apply to all alloyed steel regardless of composition? If so, what is its justification for asserting that this would all be a slight modification? If not, what cut-off point does it recommend and how would it justify such delineation?

It should not be acceptable to have an open-ended application, as is the case here. At some point, enough elements added must make the product sufficiently distinct, so some cut off point would need to be identifiable if BLS is to get any relief.

Customs authorities would also have no way of knowing whether a revised dumping duty notice would apply to products or not based on the lack of clarity in the application. This is obvious in the context of ADA Art 12.2.1(ii) which requires "a description of the product which is sufficient for customs purposes" in notices of measures.

The application is misleading and/or incorrect

In the Visit Report, BLS asserts that boron "does not impact the steel in any way." Yet in the initial application, BLS refers to US cases, but makes no mention of the fact that one of the cases it must have found, saw the Department of Commerce in the US hold "that there are commercially and metallurgically viable reasons for the addition of Boron in the context of the Continuous Annealing Process ("CAP")." It concluded that for producers of corrosion-resistant carbon steel who use CAP, "the addition of Boron is not 'immaterial' to the performance characteristics of the final product."

The supplier of the goods in relation to which Wright Steel has been designated by BLS, uses CAP. There is simply nothing in the application by BLS to explain why a different outcome is sought or is justifiable in Australia. There is simply no evidence whatever in the application as to the impact of boron or other additives to the functionality of steel. Interested parties should only have to respond to meaningful evidence from the applicant. In the absence of any such evidence and in light of BLS's failure to address the adverse findings in cases it itself alludes to, the investigation should be terminated. ADA requires a reasonable body of evidence from an applicant to warrant the time, cost and commercial disruption imposed upon interested parties by any investigation.

More serious is the fact that BLS must be aware of other research that at least needs to be addressed. As noted above, BLS supports at least one university research centre, whose newsletters announce relevant papers. One such newsletter is attached which announces one boron related study. ADC deserves a properly argued and analysed submission from the applicant, rather than unsustainable sweeping statements that fly in the face of known science.

The application does not address each of the designated factors

The lack of evidence as to functionality is part of a wider defect in the application. The application concentrates on import volumes and cost to produce. Yet the regulations identify

13 non-exhaustive factors that must be considered. It would be improper to continue to conduct an investigation not grounded in sufficient attention by the applicant to each factor, once it is evident that the applicant could easily have done more in that regard. This would be problematic from a due process perspective and would lead to the investigation being in effect a fishing expedition, purporting to shift the onus onto the targets of the application.

A number of ADA provisions point to problems if this inadequate application is allowed to justify the continuation of the investigation. ADA Art 6.2 provides that "(t)hroughout the anti-dumping investigation all interested parties shall have a full opportunity for the defence of their interests." ADA Art 6.5.1 provides that "(t)he authorities shall require interested parties providing confidential information to furnish non-confidential summaries thereof."

These summaries shall be in sufficient detail to permit a reasonable understanding of the substance of the information submitted in confidence. A respondent to an application of this nature should be able to see BLS's assertions as to each of the 13 factors. This is not the case with this application.

The proposed measure would be improperly retroactive

The Regulation that allowed for an argument that physical modifications might constitute circumvention came into force on 1 April 2015. In addition to the Australian law presumption against retrospectivity, ADA Art 10.1 provides that "(p)rovisional measures and anti-dumping duties shall only be applied to products which enter for consumption after the time when the decision taken under paragraph 1 of Article 7 and paragraph 1 of Article 9, respectively, enters into force, subject to the exceptions set out in this Article."

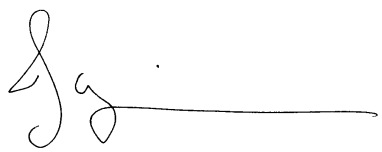
The Notice initiating this inquiry states that the alleged circumvention goods to be considered will be those exported between 1 July 2011 and 31 March 2015. It should not be proper to consider importations that all occurred prior to the relevant Regulation, in considering whether they are in compliance or to impose duties based on imports at a time prior to existence of the Regulation purporting to grant the relevant taxing power. Australia would again be in breach if it adopted this approach.

(Confidential material deleted)

Conclusion

Wright Steel Sales and CITIC Australia Commodity Trading Pty Ltd ask that the Commission consider these matters and employ its powers to terminate the investigation forthwith. If necessary, ADC should ask DFAT and AGD for advice as to compliance matters.

Yours faithfully



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The Gleeble® NEWSLETTER

Summer 2011

Come See Us at the Shows

Recap: Gleeble User Workshop India (GUWI)

The 3rd Gleeble User Workshop and National Conference on Thermo-Mechanical Simulation using Gleeble Systems was held September 16–18, 2011 at JSW Steel Ltd., Vidyanagar, Near Bellary, Karnatata State, India. Building on the success of the earlier two Gleeble User Workshop and Conferences that were held in 2008 and 2010, the conference featured well-known researchers and speakers from manufacturing, industry and research institutes.

Topics included:

- Continuous casting
- Rolling and forging
- Welding
- Strip annealing
- New applications and innovations
- Challenges in Gleeble testing and solutions

For additional information, please contact Mr. Suyash Nadkarni at ss_nadkararni@yahoo.com

1st Workshop on Gleeble Welding Process Simulation & Gleeble Welding Group Meeting

Gleeble Welding Group Workshop and Meeting will be held Feb. 27–28, 2012 in Graz, Austria. It will focus on the exchange of information about experiments related to welding processes carried out with any Gleeble machine.

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Gleeble Application Story

The Gleeble at the University of Wollongong and BlueScope Steel

The BlueScope Steel Metallurgy Centre, University of Wollongong was established in 1995, consolidating a long history of collaboration between the University and BlueScope Steel. It undertakes strategic, basic and applied research that complements the in-house research capacity of BlueScope Steel and provides related undergraduate and post-graduate education. Operating funds are shared between UOW, BlueScope Steel and the Federal Government's Australian Research Council (ARC) through competitive research grants. BlueScope Steel is a global steel producer and the leading steel company in Australia and New Zealand.

The Centre focuses on research outcomes, development of research capacity, and the fostering of an awareness of steel research in the national and international arena. In this capacity it provides opportunities for academic staff to play a greater part in supporting the local steel industry and for technologists from industry to contribute to academic development. It also gives students access to industry, as well as giving them advanced educational opportunities in steel products and processes. Since 1997 the Centre has conducted research on numerous competitive grant projects with a total budget of nearly $10 million.

Research activities are conducted in several key areas focusing on the changing needs of BlueScope Steel as the company has responded to changes in its commercial environment. The Pyrometallurgy Research Group focuses on iron and steel making processes, and on sustainable

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The busy Gleeble laboratory at the BlueScope Steel Metallurgy Centre, University of Wollongong.

Recent Gleeble Papers

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The Mechanism of Brittle Fracture in a Microalloyed Steel: Part I. Inclusion-Induced Cleavage

by D.P. Fairchild, D.G. Howden, and W.A.T. Clark

The cleavage resistance of two microalloyed steels (steels A and B) was studied using several tests, including the instrumented precracked Charpy and Charpy V-notch (CVN) techniques. Ductile-to-brittle transition temperatures were measured for the base-metal and simulated heat-affected zone (HAZ) microstructures. Steel B showed inferior cleavage resistance to steel A, and this could not be explained by differences in gross microstructure. Scanning electron fractography revealed that TiN inclusions were responsible for cleavage initiation in steel B. These inclusions were well bonded to the ferritic matrix. It is believed that a strong inclusion-matrix bond is a key factor in why TiN inclusions are potent cleavage initiators in steel. Strong bonding allows high stresses in a crack/notch-tip plastic zone to act on the inclusions without debonding the interface. Once an inclusion cleaves, the strong bond allows for transfer of the TiN crack into the ferritic matrix. It was estimated that only 0.0016 wt pct Ti was tied up in the offending inclusion in steel B. This indicates that extended times at high temperatures during the casting of such steels could produce TiN-related toughness deterioration at even modest Ti contents.

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Development of Ultrafine Grained AA5083 Using MAXStrain® Thermal Mechanical Simulator

by W. Chen, D. Ferguson, H. Ferguson, R. Mishra and Z. Jin

Ultrafine grain structures of metallic materials have become more and more attractive to academic and industry researchers due to their high strength and high toughness. Several techniques have been developed to produce the ultrafine grain structures primarily using a sever-plastic-deformation method, such as equal channel angular pressing (ECAP), 3D forging, torsion straining with or without applying axial pressure, and accumulative roll bonding (ARB) technique. Recently, a new multi-axis restraint deformation technique (MAXStrain®) was developed to study ultrafine-grained materials. This technique promised to easily produce much larger-size metals, compared to other methods developed. In this study, we adopted this multi-axis restraint deformation technique and developed the ultrafine grain structures of a commercial aluminum alloy AA5083 using the MAXStrain thermal-mechanical simulator. The grain structures of the deformed AA5083 were characterized using electronic microscopes as a function of strain. Mechanical properties were also evaluated and correlated with the resultant grain structures and the related processing parameters.

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Effect of Boron on Hot Ductility of Low Carbon Low Alloyed Steel

by H.-W. Luo, P. Zhao, Y. Zhang, and Z.-J. Dang

The influence of boron on the hot ductility of C-Mn-Al-Cr steel has been investigated. At < 980°C M(CB) precipitated out and about half of the boron content was in solution in austenite at < 900°C. It was found that solute boron atoms segregate to austenite grain boundaries and occupy the vacancies induced by deformation. This prevents the formation and propagation of microcracks at boundaries and results in improved hot ductility and a reduced dynamic recrystallisation temperature.

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Stressed Heat Affected Zone Simulations of AerMet® 100 Alloy

by Joseph D. Puskar

AerMet® 100 is a high strength, high fracture toughness alloy designed for use in aerospace applications. In previous work the welding behavior of this alloy has been evaluated, and it has been shown that a softened region in the heat-affected zone (HAZ) is a principal feature of the weld zone. A model of this softening, based on classical theories of precipitate coarsening and isothermal softening data, was developed and found to provide a reasonable description for weld thermal cycle simulation (Gleeble) experiments. Recent work has shown, however, that softening in real welds is not always well predicted by this model, so that additional effects, which are not captured in conventional Gleeble thermal cycle simulations must be addressed. In Particular, the stresses associated with real weld HAZ's may modify the softening kinetics. In the current work, Gleeble simulations in both stress-free and stressed conditions have been conducted and the kinetics compared. The accuracy of the thermal model predictions have also been considered regarding their impact on estimated hardness values.

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Segregation of Phosphorus and Sulfur in Heat-Affected Zone Hot Cracking of Type 308 Stainless Steel

by L. Li and R.W. Messler, Jr.

The Auger microprobe analysis method was employed to indentify the presence and characterize the degree of interfacial segregation of P and S associated with weld heat-affected zone hot cracking in Type 308 austenitic stainless steel. Crack surface samples for Auger analysis were produced under a controlled evacuated and argon back-filled atmosphere on a Gleeble® thermomechanical simulator. Sulfur was found to strongly segregate to the intergranular fracture surface, while segregation of P, confirmed by earlier EDS analysis, was undetected by the Auger equipment employed. The relatively stronger tendency for S to segregate correlates well with this elements' higher diffusion rate compared to P and with cracking susceptibility test results, which showed S to be more detrimental that P to HAZ cracking.

Using Type B Thermocouples

The use of type B thermocouples is becoming more popular among Gleeble operators because they have greater stability at high temperatures and are not affected by oxygen as are tungsten thermocouples. Before you use a type B thermocouple, however, there are some things you should know:

• Because of a double-valued performance curve and extremely low setback coefficient at low temperatures, the type B thermocouple is virtually useless below 50°C. It will not perform the same as other thermocouple types at room temperature.

• Accuracy for type B thermocouples is specified > 800°C (+/–0.5C). Below 800°C, the type B thermocouple is not specified for any accuracy. As a result, do not use type B thermocouples for important temperature measurements below 800°C.

We recommend power control for the initial heating of the specimen. As starting place for power control when transitioning to thermocouple control using a type B thermocouples with a 10 mm steel specimen, try the following:

• Set power angle to 40°
• Wait tcl > 400°C
• Ramp tcl to 1200°C in 100 sec.

For more information about the specifications and performance of type B thermocouples, consult:

http://www.omega.com/temperature/z/pdf/z036-040.pdf

http://www.omega.com/temperature/z/pdf/z212-213.pdf

High Temperature MCU Introduced

A special MCU (Mobile Conversion Unit) designed for tensile and thermal testing at sustained operating temperatures up to 3,000°C is now available for use on Gleeble 3500 or 3800 systems.

The new MCU features modified water cooling circuits to protect jaws, grips, load cell and other MCU components when operating at high temperatures and also has special heat shielding of extensometers. A special two-color high temperature pyrometer is used for thermal control.

The high temperature MCU includes an atmosphere control tank for testing in gas or vacuum and can be retrofitted to existing Gleeble 3500 and 3800 systems.

For more information about the high temperature MCU, please contact us here at DSI.

9th International Trends in Welding Research Conference

The 9th International Trends in Welding Research Conference, to be held June 4–8, 2012 in Chicago, features five days of technically-intensive programming focusing on both fundamental and applied topics related to welding and joining.

Top researchers and colleagues from around the world from industry, government and academia will present the latest in experimental and modeling developments in the following areas:

• Friction Stir Welding
• Microstructure
• Phase Transformations
• Properties and Structural Integrity of Weldments
• Residual Stress and Distortion
• Sensing, Control and Automation
• Solidification
• Transport Phenomena
• Weldability
• Welding Processes, Procedures and Consumables
• Other Experimental/Modeling Investigations

For further information on the 9th International Trends in Welding Research event, contact ASM at:

ASM International
Member Service Center
9639 Kinsman Road
Materials Park, Ohio 44073-0002 USA
(800) 336-5152
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Fax: (440) 338-4634
email: memberservicecenter@asminternational.org
www.asminternational.org

Come See Us at the Shows

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Topics will include:

• Welding processes: conventional arc welding, resistance (spot) welding, solid state welding such as friction stir welding, etc.

• Metallic materials: steels, aluminium, titanium, magnesium, nickel, etc.

• Similar and dissimilar joining

• Discussion about problems and solutions of Gleeble experiments

Registration deadline and fees:

• Presentation (title and short abstract) — Dec. 17, 2011
– Workshop and dinner (1st day)
– Gleeble Welding Group Meeting (2nd day)

• Participation — Jan. 30, 2012
– 1st day (fee 50€)
– 2nd day (fee 50€)
– Ph.D. students (50% discount)

Please register via email or fax stating first and family name, address, telephone number, email address, and send it to:

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European Gleeble Users Group Meeting

European Gleeble Users Group meeting—to be held in Delft, Netherlands, Spring, 2012. Watch for more information about this event.

Gleeble at Univ. of Wollongong and BlueScope Steel

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smelting technologies for low greenhouse gas emissions. The Physical Metallurgy Group concentrates on thin strip continuous casting technology, thermo-mechanical processing, steel product development and physical metallurgy of welding. The casting part of this program contributed to the development of the recently commercialised thin strip casting process, Castrip®.

Practically, this means there are constantly multiple large joint research projects running, which currently involve five Ph.D. students and a number of undergraduate projects. In general, BlueScope Steel makes a sizeable contribution towards purchasing analytical equipment, while the university operates and maintains it and provides support staff. Project costs are then usually split. A very positive side-effect of this arrangement is that it ensures the university graduates are highly skilled in those fields that are relevant to BlueScope Steel.

The BlueScope Steel company specializes in the production of premium metallic coated and painted steel building products and supplies customers in Australia, New Zealand, Asia, the US, Europe, the Middle East, the Pacific and elsewhere.

BlueScope employs 21,000 people in 17 countries, with over 100 manufacturing facilities worldwide. The steelworks at Port Kembla in New South Wales is the largest steel production facility in Australia and one of the world's lowest-cost producers of steel products. BlueScope Steel is widely recognised for fostering the development of innovative steel solutions through its own research and through strategic alliances with world-leading technical partners.

A wide variety of tests and physical simulations are performed on the Gleeble at the BlueScope Steel Metallurgy Centre. These include plane strain compression tests on high strength steels to simulate thermomechanical processing for alloy and process development, simulation of novel thin strip casting and hot rolling processes to assist in setting up the world's first Castrip® Plant, and hot tensile tests to measure ductility at elevated temperatures to simulate slab casting and thin strip casting.

Other studies encompass investigations of scale build-up under different atmospheres, for example to simulate conditions in hot and cold rolling, plane strain compression tests on very thin (1.6 mm) samples and ultra fast quenching to reveal prior austenite structure for steels with low hardenability, and welding simulations on a wide range of steel grades and conditions. Additional investigations focus on simulation of thin strip casting and hot rolling with complex programs including several rapid cooling and re-heating steps.

Tom Schambron, product development metallurgist at BlueScope, says, "Since world research and innovation are cornerstones of our business, the Gleeble is key to meeting the objectives of BlueScope. It assists in product development and improvement—such as trialling new steel grades, processing parameters, and so forth—and in tracking and solving of quality issues."

For example, BlueScope has used the Gleeble for measuring critical processing parameters (Tgc, Tnr, Ar3) for new steel grades, which has enabled the company to adjust the composition and to design the processing schedule. In addition, the Gleeble was used to determine the temperature range of low ductility during slab and thin strip casting, vastly reducing the number of casting cracks. The Gleeble has also been instrumental in proof of concept work for patent applications.

Investigations conducted using the Gleeble assisted in the development of a new generation of high strength pipeline steels and provided valuable interaction and exchange between academics from the University of Wollongong and BlueScope Steel researchers. Further, results obtained from Gleeble experiments led to numerous peer-reviewed publications.

A unique experimental technique was developed at the University of Wollongong to simulate the extreme thermal and atmospheric conditions experienced during electric resistance welding (ERW) of steel pipe. The technique utilizes the Gleeble 3500 thermal-mechanical simulator in pocket jaw configuration. Specimens are rapidly heated from 25 to 1300°C in 0.5 seconds, then held at this temperature for various time periods. Tubular-shaped specimens are used and a dry or humid oxidizing gas was passed through the central bore during the heating cycle. After heating, the outside wall of the sample is cooled by water quenching. Oxidation on the inside wall of the specimens is then studied. The oxidation products are similar to that observed in standard ERW pipe. This experimental simulation will prove useful in the assessment of ERW steel weldability prior to the current (expensive) approach of conducting full-scale pipe mill production trials.

The development of this technique has been a collaborative effort between researchers at the University of Wollongong and Bluescope Steel. The concept for the technique was first proposed by Mr. Mark Reid (Research Fellow), and it was developed by Mr. Matthew Franklin (PhD Student) and Mr. Robert DeJong (Gleeble Manager). Valuable contributions were made by Dr. Frank Barbaro from Bluescope Steel, Professor Rian Dippenaar, and Professor John Norrish from the University.

Details of the experimental technique were presented by Mr. Matthew Franklin at the Materials and AustCeram 2009 conference, Gold Coast, Queensland, Australia, 1–3 July, 2009.

For three years, Dr. Ali Dehghan-Manshadi (Research Fellow) has been conducting a number of experiments on the Gleeble and the Hydrawedge. These include studies on: dynamic, static and meta-dynamic recrystallization of different grades of steel, deformation behavior of centerline precipitates in low Mn, low C pipeline steels, transformation-precipitation interaction in steel structures, and hot deformation and recrystallization in titanium alloys. He has also been investigating strain induced phase transformation in titanium alloys using the Gleeble's pocket jaws.

Schambron says, "The Gleeble makes our investigations easier through its ability to test outside the range of the capabilities of our production facilities. It allows us to systematically change individual process parameters, and it gives us quick set-up and turn-around time which translates into the ability to get results instantly and at low cost."