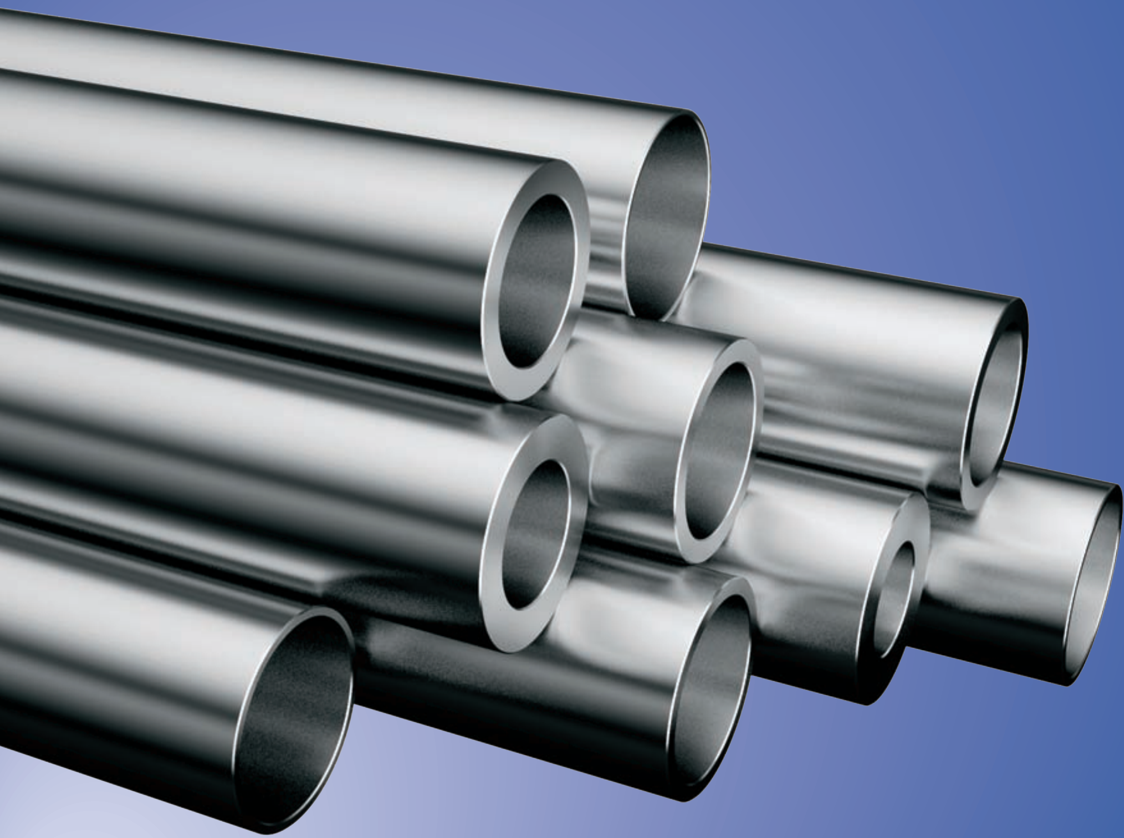
BAOSTEEL-AUSTRALIA
JOINT RESEARCH AND DEVELOPMENT CENTRE

ANNUAL REPORT 2013–14



BAOSTEEL

MONASH University

UNSW THE UNIVERSITY OF NEW SOUTH WALES

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

UNIVERSITY OF WOLLONGONG

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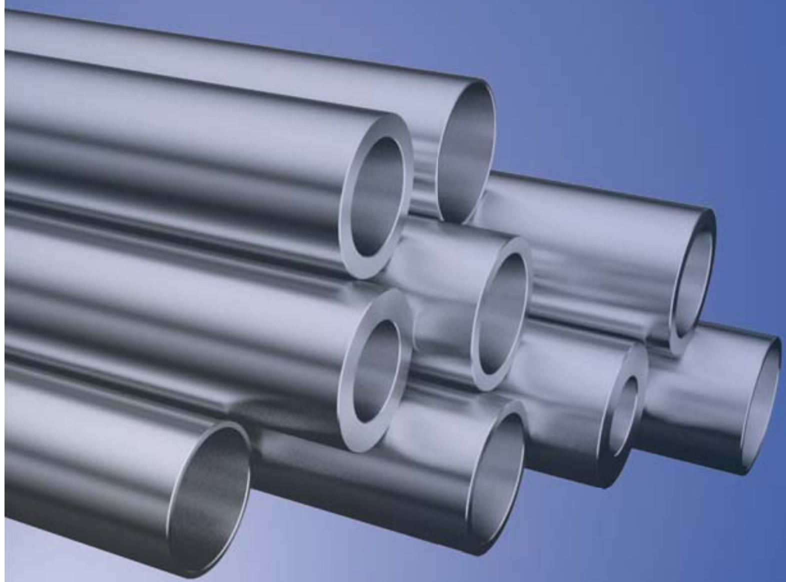
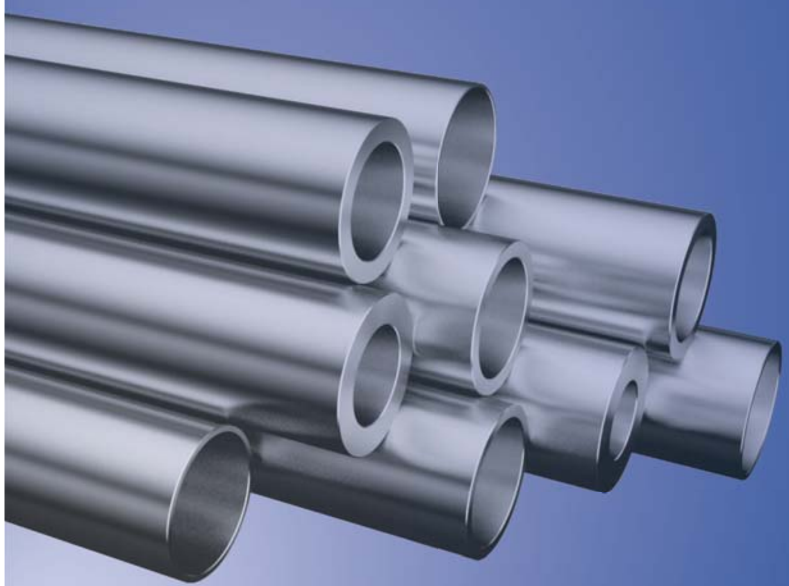




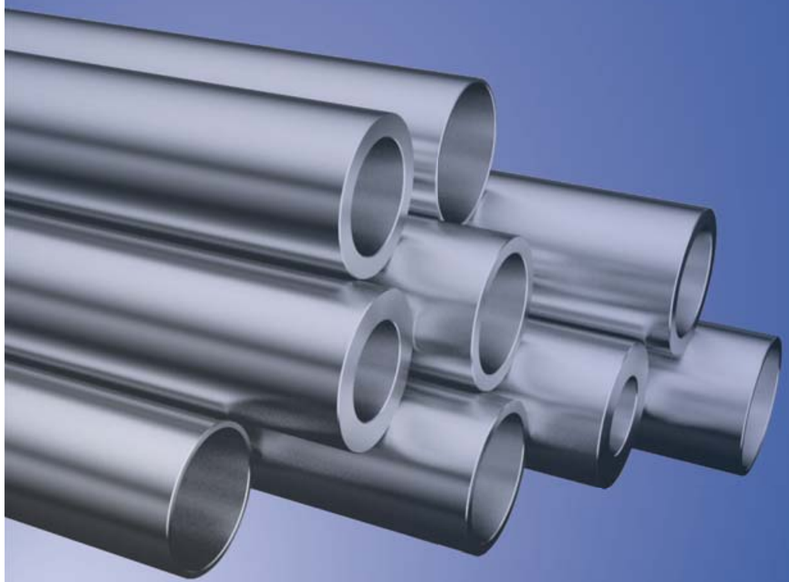
mission and vision

The mission of the Centre is, through an enduring partnership, to engage in exploring and developing new knowledge and technologies within selected areas of particular significance for Baosteel's longer term, strategic development and business activities. The Centre is functionally located within the School of Chemical Engineering, Faculty of Engineering, Architecture and Information Technology (EAIT), the University of Queensland.

The purpose of the Centre is to create an internationally recognized Centre of excellence in the research area by harnessing and developing existing and emerging talent within the participant institutes to fulfil the mission of the Centre. The specific aims of the Centre incorporate:

- Conducting strategic research supporting Baosteel's business interests, in approved priority themes including innovative materials, new energy, resource utilization and advanced environmental technologies.
- Providing strategic consultancies and technical advice for Baosteel's long-term and sustainable development.
- Promoting application of innovative technologies and development of new, high value and low carbon products in Baosteel.
- Providing a platform for Baosteel to access the international technical and personnel recruitment marketplace.
- Strengthening the academic/technical exchange between Baosteel and Australian universities and providing access to other innovations within these universities which may be of interest to Baosteel.

executive reports



Board Co-chair's Message

The Baosteel-Australia Joint Research and Development Centre (BAJC) partnership, after just 3 years of operation is now poised to deliver research and innovation driven real value to its major sponsor, Baosteel. A steady stream of technologies is working through the vetting processes towards patent, and a number of projects have plans being developed for larger scale demonstration.

A second goal of the Centre, to develop the professional careers and collaborations of the research teams, and advance the strategic objectives and capabilities of the Partner Institutions, is reflected in a number of staff and PhD students engaged with Centre projects, the technical publications that they produce and the leveraging of BAJC funding through competitive grants. The body of this annual report provides a snapshot of these substantial and significant outcomes.

The third goal is cementing the bonds between Australia and China in technical and scientific collaboration. In this respect, every one of the 26 projects now managed through BAJC, involves regular visits to China to engage with their project team counterparts in Baosteel, and many have hosted Baosteel specialists on technical exchanges to their Australian laboratories.

With the enthusiastic support of the senior management of the Partner Universities and Baosteel, through the Centre Board, we remain passionate and proud that the vision and objectives of the Centre are now coming to fruition. This reflects the dedication, hard work and level of expertise that the project teams bring to their research and development activities, and their determination to improve the world through international collaboration in science, technology and innovation.

Director's Report

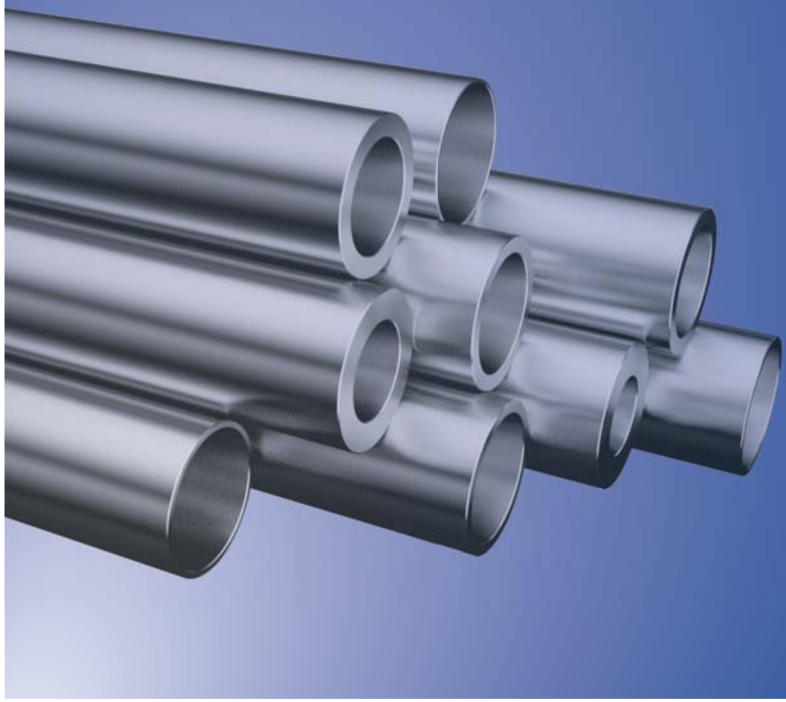
BAJC is well into its third year of operation and entering a phase where it is starting to deliver of potential commercial outcomes and results of scientific importance. This is reflected in a number of well established relationships and extensive interchanges between the Australian based research teams and their industrial counterparts within Baosteel, patentable technologies being put forward for assessment and support, the number of PhD and early career Postdoctoral Fellows working on projects and a robust stream of quality technical publications. These all testify to the value of the work being performed and the ongoing and robust development of the Centre.

There are now 26 projects managed by BAJC, with total cash commitments of $3.8m and $6.6m of additional in-kind support in the year 2013-14. The projects are at different stages of technical maturity, but all are directed ultimately at commercial value by providing safer, cleaner and more productive processes or products. The achievements of the Centre, summarized in the body of this annual report, reflect the hard work of project teams, with the support of the senior management of Baosteel and the partner organizations

Many of the first tranche of projects that started about two and a half years ago are now coming to the point where they need to move into a testing or demonstration phase, beyond what can be accommodated in university based research environments; and planning is well under way for transposing these for further development within Baosteel facilities. This will further strengthen the already close ties and working relationships that have developed between the research teams in Australia and their Baosteel counterparts.

The second BAJC Conference, hosted by Monash University, was held in January 2014, establishing this as an annual fixture in the BAJC calendar. These meetings provide an opportunity to meet up with colleagues and new BAJC project participants, celebrate our successes and for our PhD candidates and early career researches to network, develop and share their experiences. Planning is proceeding for the third conference, to be hosted by UNSW.

projects and outcomes



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TOTAL PROJECTS				**26**

PROJECTS AND OUTCOMES – ROUND 1

PROJECT ID BALP1100

Project title

Nano- and micro-scale engineering of MoS2-based catalyst for conversion of syngas to ethanol

Project leader

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Principal researchers

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A/Prof. Geoff Wang
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OBJECTIVES AND BENEFITS

Steel-making produces large quantities of residual H2 and CO, which can be converted into value-added commercial ethanol if problems achieving suitably high yields, selectivity and process intensification are overcome. This project addresses these issues through innovations directed at: (a) high selectivity through new catalyst development; (b) very close control of the reaction temperature using high thermal conductivity, geometrically structured catalyst support; and (c) microchannel reactor architecture for high throughput.

It seeks to enable Baosteel to convert syngas into commercially–viable ethanol for use as a petrol substitute, offering significant new opportunities in the global transport fuel market.

HIGHLIGHTS AND ACHIEVEMENTS

July - December 2013

– Tested NiMoS2 based catalyst synthesized by microemulsion method, in catalytic conversion of syngas to ethanol.
– Simulated reactions and mass/heat transport using COMSOL in the microchannel reactor.
– Designed and built a double-layered reactor.

January – June 2014

– Introduced potassium as an ethanol enhancement promoter.
– Built a new microchannel reactor reaction system, wherein the catalysts will be tested for long stability runs and ethanol production performance. The innovation of the system lies with the reactor design that consists of mini channels where the catalyst material is deposited. Two features of the design are: (i) easy control of reaction exothermicity and (ii) large reaction volume reduction for same alcohol production when compared with traditional fixed bed reactors.

PROJECT ID BA11001

Project title

Innovative approaches to investigating the formation of thin-gauge metallic strip directly from the molten state

Project leader

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Dr Kevin Laws (UNSW)
Dr Zakaria Quadir (UNSW)
Dr Yuan Fang (Baosteel)
Dr Yan Yu (Baosteel)
Dr Xiufang Wang (Baosteel)

OBJECTIVES AND BENEFITS

Metallic sheet production has an estimated annual global market of over US$1 trillion in the construction, automotive, packaging, aircraft and aerospace industries. This project seeks to identify more efficient processes to manufacture high-quality sheets from metals and alloys of specific interest to Baosteel.

The research uses a powerful substrate immersion technique, coupled with twin roll casting (TRC) trials, to investigate the effect of key processing parameters on the development of as-cast structures and reduce defects in various types of metallic strips.

HIGHLIGHTS AND ACHIEVEMENTS

July - December 2013

– Completed the experimental program on defect formation processes and mechanisms in strip-cast low carbon steel.
– Developed an experimental plan for dip testing new types of high strength LC microalloyed steels, following an extensive literature review and our 4th technical meeting between UNSW and the Baosteel twin roll casting team in June 2013.
– Completed the first series of dip testing experiments.

January - June 2014

– The experimental program completed in 2013 culminated in several recommendations made to Baosteel strip casting team for eliminating large-scale cracking on as-cast LC strip in the TRC plant at Ningbo.
– The dip testing experiments plans reported in 4th technical meeting between UNSW and Baosteel twin roll casting team, have been completed in June 2014, whereby a series of Fe-C-Si-Mn-Nb compositions were cast into both single- and double-sided coupons.
– The single-sided coupons produced in Australia demonstrated a unique combination of microstructure and high strength (hardness). The double-sided coupons were recently cast at Baosteel (Shanghai) for carrying full mechanical testing (tensile properties) at UNSW.

PROJECT ID BA11002

Project title

Study of homogenisation and recrystallization effects in forged Ti- 64 ingot and research in powder HIPping (Hot Isostatic Pressing) of Ti-64 powder

Project leader

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Principal researchers

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Dr Colleen Bettles (Dec 2013 Retired)
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Mr Kai Zhang

OBJECTIVES AND BENEFITS

This project aims to improve the homogeneity of Ti-6Al- 4V (Ti-64) forged ingot and to study the industrial scale of HIPping Ti-64 powder. For the forged ingot research, experimentation and modelling is employed to investigate the thermo-mechanical process effect on the recrystallization behaviour and homogeneity of largeTi-64 ingot. This work has provided Baosteel with full knowledge of the quality of their cast product in terms of microstructure, macrostructure, chemical variation and β- transus temperature; knowledge of the processing window for the (α+β) forging of the Ti-6Al-4V billet; understand the possible source for quality inconsistency in billet production; issues related to microstructure evolution and strain distribution and, how to control uniformity quality in the forged billet. A computer simulation tool helps to understand and control the forging and cogging process.

HIGHLIGHTS AND ACHIEVEMENTS

July 2013 – December 2013

- Established modelling cogging parameters.
- Investigated the high-cycle fatigue properties of Ti-64 samples and the effect of macrozones on crack initiation. Further analysis is currently ongoing.
- Prepared for planned full-scale cogging validation trials at Baosteel.
- Project meeting with Baosteel in Shanghai, and assisted Baosteel Ti team with hot compression test using the Thermecmaster Z machine.

January 2014 – June 2014:

- Identified macrozone characteristics affecting crack initiation.
- Meeting with Baosteel Ti team in Shanghai, and went with Baosteel Ti team to establish evaluate testing system for industrial environment compression of larger size samples.
- Evaluated Baosteel cogging process. Areas of improvement have been identified.
- Validation of the previously established model used for simulation and the microstructure evolution map completed using the lab-base double cone test.
- Tried using a larger tonnage hydraulic system for forging experiment of larger size billet. Modification to improve its control and data collection system for future testing purposes completed.
- The processing parameters for the HIPped powder were identified and the HIPped powder was successfully produced from Baosteel's bar stock.

PROJECT ID BA11003

Project title

Development of highly formable magnesium sheet

Project leader

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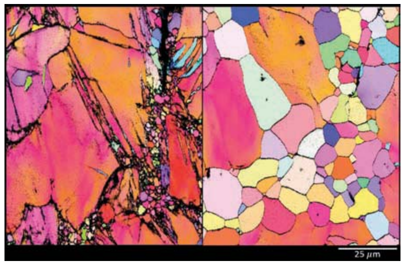
Dr Mingzhe Bian
Mr Zhuoran Zeng
Mr Xiaojian Xia

OBJECTIVES AND BENEFITS

This project aims to deliver a cost-effective magnesium alloy with superior formability and thermo-mechanical processing parameters, to fabricate stronger, highly formable and corrosion-resistant sheet at near room temperatures with satisfactory environmental performance and coatability. The research will characterise and evaluate micro-alloyed Mg-Zn-Gd, Mg-Zn-Ca and Mg-Ca-Zn materials, produced under different alloy compositions and thermo-mechanical processing conditions. This project will help Baosteel make value-added lightweight magnesium sheet products for use in the automotive, rail transport and computer industries. It will advance Australia's research capacity, and promises to boost international demand for Australian magnesite.



HIGHLIGHTS AND ACHIEVEMENTS

July - December 2013

- Cast and hot rolled Mg-Zn-Ca and Mg-Ca-Zn based ingots.
- Characterized and evaluated the formability and age hardening behaviour of annealed sheets of the above alloys.
- The corrosion/electrochemical tests are ongoing. Testing was carried out upon the BG-series alloys and a selection of custom ternary alloys.

January – June 2014

- Based upon previous experimental results, BG1-M1 and BG3- M1 exhibited superior mechanical properties in terms of strength and formability among the BG- series alloys.
- Optimized the thermomechanical processes for the B1- M1 and B3- M1 alloys.
- Discussed the strategic project alignment during the meeting at Baosteel in late May.

PROJECT ID BA11006

Project title

Scalable production of graphene-based bulk nanomaterials for advanced energy storage

Project leader

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Principal researchers

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Dr Yu Lin Zhong

OBJECTIVES AND BENEFITS

This project aims to address the industrial challenges inherent in the cost effective and scalable production of graphene, and its bulk assembly for use in high performance energy storage devices. Its key technical objectives include the exfoliation of graphite into corrugated graphene sheets; the processing of exfoliated graphene into thin films; and the assembly of graphene thin films into new- generation energy storage devices. The project will develop patentable new technologies for the emerging and highly-profitable energy storage market, providing Baosteel with an opportunity to open up a new portfolio of high value added products for the clean energy sector.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

– Carried out the optimisation of liquid phase exfoliation and made different attempts to assemble the exfoliated graphene into thin film electrode for supercapacitor testing.

– The electrochemical exfoliation of graphite was started in Aug 2013 and has been producing a number of breakthroughs and success in terms of scalable and cost-effective exfoliation of loose graphite flakes.

– Established unique chemical functionality and physical property of EGO.

January – June 2014

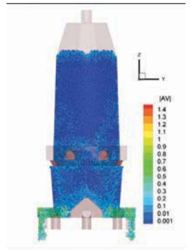
– Currently, optimization and technology development is continuing for scaling up of the electrochemical production from the milligram to gram scale and it will, in principle, demonstrate the scalability of the method.

– Optimised processing and reduction of EGO into film electrodes and further supercapacitor testing.

PROJECT ID BA11009

Project title

Process modeling and analysis of ironmaking processes for improving energy efficiency in Baosteel



Project leader

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Principal researchers

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OBJECTIVES AND BENEFITS

This project aims to understand and model the fundamentals governing the multiphase flow and thermo-chemical behaviour in iron-making processes including blast furnace (BF) and COREX. It will (I) develop and validate computer models to reliably describe BF and COREX iron-making processes, (II) investigate the effects of key variables related to raw materials, operational and geometrical conditions, and (III) formulate and test strategies for the design, control and/or optimisation of BF or COREX iron-making processes under different conditions. By answering fundamental questions about BF and COREX, and identifying strategies to control problems, the outcomes may lead to industrial benefits such as an extended life campaign, better operational control, decreased fuel consumption, improved productivity, and reduced CO2 emissions.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

– Refined and further developed existing BF models for their application to specific BFs in Baosteel.

– Conducted a series of parametric studies by using the developed BF models based on operational conditions of Baosteel BFs.

– Developed a DEM-based model to simulate solid flow in a screw feeding system and carried out parametric study to understand the effect of cohesive force and rotational speed of screw feeder.

– Developed a combined CFD-DEM model to investigate the effect of gas flow in Reduction Shaft,

– Detailed study of the solid flow in the full-scaled Reduction Shaft to understand the effects of cohesive force and rotational speed of screws are carried out in three geometry settings (simplified, with and without AGD).

– Formulated some measures to reduce the effect of cohesive force on solid flow in Reduction shaft, with some tests conducted in the simplified screw feeding system.

– A combined CFD-DEM model for Melter Gasifier is developed to investigate the gas-solid flow behaviour in Melter Gasifier.

– Heat transfer model is incorporated to the combined CFD-DEM model for Baosteel Reduction Shaft and Melter Gasifier to investigate thermal behaviour, with some preliminary results generated.

January – June 2014

– The BF process model and tuyere model previously developed in UNSW under fixed geometry and material conditions has been modified to simulate Baosteel BFs.

– A sub-model developed in our other project has been integrated into the present BF process model for investigating a new technology - shaft injection. The integrated model has been tested using the data measured in a lab-scale blast furnace.

– The developed BF models (process model and tuyere model) have been used to simulate Baosteel BFs.

– Carried out the preliminary test of a thermo-chemical model for Baosteel Reduction Shaft and Melter Gasifier.

PROJECT ID BA11011

Project title

Waste heat recovery from steelworks using advanced thermoelectric materials and generator technology

Project leader

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Principal researchers

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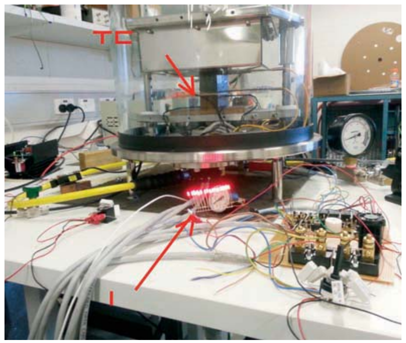
OBJECTIVES AND BENEFITS

This project seeks to use advanced thermo-electrical (TE) technology to develop advanced prototype TE generators. It will investigate, develop and optimise bulk TE modules made from naturally-abundant elements which are stable at high temperatures and have high comparative conversion efficiency. An industrial scale TE device will be designed and manufactured using experimental and theoretical data. This project will enable Baosteel to become an industry leader in energy-efficient steel manufacturing by using TE power modules and generators to harvest waste energy, cutting its carbon footprint and energy costs.



HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- Optimized the reaction parameters and operational parameters of our device which is able to light up LED bulbs and will be used to evaluate the conversion efficiency of TE modules made from our TE materials.
- Invented two simple methods to prepare copper chalcogenide nanomaterials and submitted two patent drafts to Baosteel for evaluation.
- Carried out structure investigation and thermoelectric measurement on oxide-based bulk material and prepared a series of Bi doped sample.

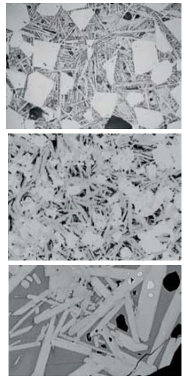
January – June 2014

- Target at low- and medium-temperature thermoelectric materials in addition to high-temperature ones, after discussion with Baosteel, as most waste heat in Baosteel factory is below 300 °C.
- Successfully prepared pure CuAgSe nanopowder using novel one-pot reaction method (under review for patent application), which exhibits novel thermoelectric properties and overcomes the instability of copper selenide.
- Prepared n-type and p-type PbTe powders and sintered them into pellets using SPS technique. The pellet density can be over 98% theoretical density after careful optimization of sintering parameters. The pellets were cut into legs as building blocks of thermoelectric module.

PROJECT ID BA11012

Project title

Identifying pathways to step change improvements in energy efficiencies and reduced CO2 emissions through the use of innovative chemistries for iron making



Project leader

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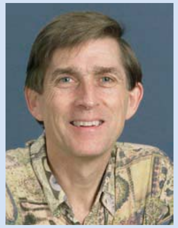

Principal researchers

Prof. Evgueni Jak
Dr Jiang Chen

OBJECTIVES AND BENEFITS

This project aims to enhance the thermal and chemical efficiency of iron-making, by improving the process outcomes of a key first step, sintering of the iron ore fines. Critical to sinter quality is the microstructure of the sinter, which is highly sensitive to chemical composition of the matrix material. New experimental techniques have recently been developed that can now provide the key fundamental information on the crystal phases that will form during sintering. This phase equilibrium information can then be applied to predict the crystal phases that will form during sintering process and the proportions of these phases, thus assisting in the optimisation of the sinter plant and blast furnace performance. The research will fill major gaps in the scientific knowledge base that will enable Baosteel to apply the research outcomes to industrial practice for a wide range of ore sources, process chemistries and temperatures.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- Developed and demonstrated the improved experimental methodology for the characterisation of phase equilibria in low-silica iron oxide systems.
- Developed an appropriate research strategy and methodology that can be used to study the remaining chemical systems.
- Obtained isothermal sections and liquidus measurements in the SFC, silicoferrite of calcium oxide primary phase fields, representing a significant step forward in understanding accurate phase boundaries of these systems.
- Extended the work to lower oxygen partial pressures in the range $10^{-3.66}$ to $10^{-3.8}$ atm. and temperatures between 1200 and 1240°C, to reproduce conditions that might be encountered in the industrial iron ore sintering process.

January – June 2014

- Experimental studies have continued on characterising the phase equilibria and liquidus for the Fe_2O_3-SiO_2-CaO-Al_2O_3 system in air in the primary phase fields of the SFCA silicoferrite of calciumaluminate oxide solid solution, Fe_2O_3, $CaO.Fe_2O_3$ and $CaO.2Fe_2O_3$.
- It has also been shown that the phase assemblages and the microstructures observed in the Baosteel plant sinter can be reproduced in the laboratory under controlled temperature and gas conditions. These results clearly demonstrate the role of both phase equilibria and reaction kinetics in developing sinter structures and provides confidence in the ability to test and verify proposed reaction mechanisms.
- In March 2014, the UQ research team visited the Baosteel Ironmaking Institute in Shanghai to present the latest findings, and discuss research plans and priorities for the coming year.
- Developed a methodology to investigate the elementary reactions occurring between components of sinter, that is, limestone, iron ore. The initial results indicate a very different reaction sequence to that reported in the literature. These reactions will be studied and analysed more closely in the remaining time available on this project.

PROJECT ID BA11014

Project title

Creating a viable titanium business for Baosteel

Project leader

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Principal researchers

Dr Shudong Luo

OBJECTIVES AND BENEFITS

This project aims to develop low-cost medium to high-strength powder metallurgy titanium alloys and their fabrication processes using inexpensive Ti powders. The research will provide Baosteel with patentable technologies to manufacture low-cost, high performance powder metallurgy titanium products for a wide range of applications in the automotive, aerospace, medical and other industries.

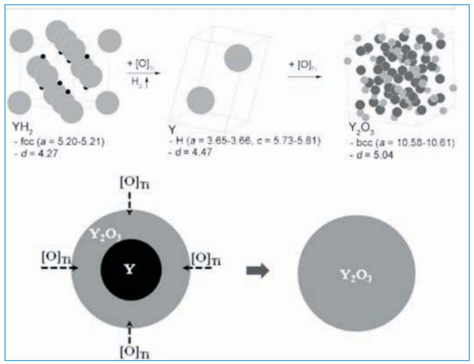
HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- Wrapped up the design and development of a range of low cost powder metallurgy titanium alloys with excellent as-sintered tensile mechanical properties, compatible with a wide range of non-fatigue critical applications. A provisional patent on the new alloys developed has been drafted and will be finalised for submission soon.
- Three different titanium parts have been fabricated and sintered using one of the new alloys developed in a powder metallurgy plant. A few processing issues have been identified.
- Succeeded in an ARC Linkage grant for 3.5 years.
- After months of effort through the UQ Research Office, the Department of Defence and the Queensland State Government have both approved the Queensland Smart Futures RPP project with Baosteel for 3 years.

January – June 2014

- A delay in the commencement of both the ARC LP130100913 and the Queensland State Government RPP project has significantly restricted the activities of the project. These two new projects totalling $1.15 million are expected to commence soon.
- Drafted and submitted a comprehensive provisional patent application document to the Centre for review.
- Confirmed the use of TiH2 powder is effective for the fabrication of the new alloy. This extends the invention based on titanium metal powder to the fabrication that can be based on TiH2 powder as well.



PROJECT ID BA11016

Project title

Advanced materials for new generation high energy storage

Project leader

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Principal researchers

Dr Da-Wei Wang

OBJECTIVES AND BENEFITS

This project aims to produce carbon-supported (C/S) sulphur cathodes with excellent stability and high specific capacity, and incorporate them into practical high-energy Li-S batteries. Using innovative Li-S technology developed at UQ, a novel class of core-shell structured carbon particles with a mesoporous core and a microporous shell will be created to enhance the energy and stability of the sulphur cathode. It promises breakthroughs in the commercialisation and use of Li-S batteries for clean energy storage and supply, particularly for use in electrical vehicles.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- The new C-N-S composite polymer material reported early 2013 is revealed to have the core-shell structure and the extended cycle stability was demonstrated for nearly 2000 cycles. A patent application is being prepared.
- Based on the discussions with Baosteel, a production facility is being set up at Baosteel. Dr Dawei Wang is working with Dr Guodong Du to set up the production facility at Baosteel. Following the establishment of large quantity production capabilities, prototype Li-S batteries based on our cathode material will be assembled and evaluated at Baosteel in next year.
- Prepared a novel graphene oxide membrane by filtration and/or evaporation methods and it was used in conjunction with the normal separator in a Li-S coin cell. The stability of the cell was improved as a result. Detailed analysis of the membrane function and the performance improvement is on-going.
- Prepared a series of Li2S8, Li2S6 and Li2S4 solutions. Carbon host materials were used to load the polysulfide salts for evaluation as Li-S cathodes.

January – June 2014

- Compared PVDF (polyvinylidene fluoride) with a series of new binders. By using these new binders, the stability of our cathode materials is extremely good, with very limited capacity reduction over more than 500 cycles.
- Experimented with Cellulose filter paper as the separator to support the graphene oxide membrane to enhance its strength. This kind of cheap functional separator can be used to replace the expensive polypropylene separators and deliver similar performance.

PROJECT ID BA11017

Project title

Control strategies of surface quality of stainless steels

Project leader

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Principal researchers

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OBJECTIVES AND BENEFITS

This project aims to investigate and solve the problem of common surface defects in stainless steel, such as cracking and deep marks in continuously cast slab, and surface oxidisation, which occur during the production process. The project will conduct fundamental research into these problems, focusing on the rolling processes, and develop effective control strategies to improve the quality of stainless steel. It will improve quality and cut production costs for Baosteel's high-tech, value-added products including stainless steel strips and plates.

HIGHLIGHTS AND ACHIEVEMENTS

January – June 2014

- Carried out the short time oxidation kinetics study on stainless steels by using the Thermo Gravimetric Analyser (TGA).
- Conducted hot rolling tests on the SUS430 steel on which oxide scale with different thicknesses and compositions formed by adopting different atmospheres and time combinations in the reheating furnace. Higher reduction resulted in better surface roughness, but this was not applicable to very thin oxide scale deformation.
- Investigated the chemical reactions between high speed steel (HSS) roll material and various extreme pressure (EP) agents, such as sulphur type, chlorine type and zinc dialkyl dithio phosphate (ZDDP). The results showed that the sulphur element, which came from sulphur EP solution, was found in the substrate and carbides.
- Mr Li Ma from Baosteel stayed at UOW from March to June 2014 as a visiting research fellow for hot rolling tests with addition of EP agents in lubricant.
- The results of scratch tests demonstrated that ZDDP exhibited a higher anti-scratch behaviour than that of other EP agents.
- Carried out further hot rolling tests on Hille 100 experimental rolling mill to determine the optimum ZDDP content in lubricant. 20% ZDDP addition in the lubricant was strongly suggested for industrial application.

July – December 2013

- Completed the fundamental research on the mechanism of sticking in hot rolling of ferritic stainless steel 445J1M.
- Mr Ming Luo from Baosteel had stayed at UOW for three months as a visiting research fellow and been very actively involved in the study. Dr Haifeng Yu and Mr Gang He from Baosteel Stainless Steel Research Centre visited UOW to discuss and exchange the research results of stainless steel 445J1M in July 2013.
- Carried out the high temperature oxidation tests of ferritic stainless steel SUS430, B443NT and B445J1M using TGA. The reheating temperature higher than 1150 °C had been recommended to Baosteel for generating relatively thick and uniform oxide scale on the surface of B445J1M.
- Carried out hot rolling tests on Hille 100 experimental rolling mill for studying deformation behaviour of oxide scale of stainless steels.
- Conducted studies on the effect of lubrication in hot rolling with focus on HSS roll. A series of EP additives have been chosen and dripped onto the samples of HSS at elevated temperature. The morphologies of the samples after the tests have been observed. Di-tert butyl disulphide and ZDDP have been identified as effective EP additives among the tested agents.

PROJECT ID BA11018

Project title

Hybrid composite metal laminates with designed cores for high manufacturability

Project leader

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Principal researchers

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OBJECTIVES AND BENEFITS

This project aims to develop new, cost-effective lightweight metal laminate materials with high strength and formability. The research will address current formability problems by designing lattice cores which enable the material to be shaped into panels with high strength to weight ratios. Truss core architecture will be topologically designed, and core-sheet bonding investigated using computational simulation techniques to create optimised truss elements, ascertain post-deformation behaviour, and develop bonding techniques. Potential commercial applications of the research include light-weight, high-strength materials which could be used to manufacture flooring and cabin structures for trains and high-speed ferries, aeroplane flooring and internal frames, and motor vehicle chassis.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- Studied sandwich panels by bending to a constant curvature in two and three dimensions.
- Defined the geometry of the sandwich panel in terms of thickness of the face-sheet (tf) and truss members (tc), truss pitch (L) and bend of struts (R).
- It was found that soft skins and hard struts are the best combination. Also, the truss pitch should be shorter to avoid buckling of the struts and provide larger residual deformation, and the struts should be thicker for the same reason.

January – June 2014

- 2D hybrid composite metal laminates with a truss core have been studied to impact. The panels have first been bent to a constant curvature and then impacted with a heavy body normal to the panel surface. After impact, the panels have been left to vibrate and the maximum reaction at the panel supports, as well as the absorbed energy at that point of time, has been elucidated.
- Conclusions have been drawn on the effect of material and panel curvature on the impact efficiency.

PROJECTS AND OUTCOMES – ROUND 2

PROJECT ID BA12002

Project title

Investigation of slag systems for low-cost iron-making by utilising low-grade iron ores and poor-quality fuels in Baosteel

Project leader

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Principal researchers

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Prof. Shengli Wu
Mr Jinming Zhu

OBJECTIVES AND BENEFITS

This 3-year project aims to enable low-cost iron blast furnace operation by using low grade ores and poor-quality fuels through systematic fundamental studies of slag behaviours in different conditions. It will use novel research techniques pioneered by the researchers at The University of Queensland to characterise the physiochemical properties and behaviours of a series of slags within the blast furnace. The project will apply these techniques to provide accurate and reliable fundamental data on the slags' phase equilibria, viscosity and desulphurisation capacity. It will significantly reduce iron-making costs by improving Baosteel's ability to use cheaper low-grade iron ores and poor-quality fuels.

HIGHLIGHTS AND ACHIEVEMENTS

June - December 2013

- Phase equilibria in the system MgO-Al_2O_3-($CaO+SiO_2$) with CaO/SiO_2 = 1.3 have been experimentally determined with over 100 experiments. A paper was presented to the High Temperature Process symposium held in Melbourne 3-4 February 2014.

January 2014

- Project meeting at UQ, Australia.

January - June 2014

- Phase equilibria in the system "FeO"-MgO-Al_2O_3-($CaO+SiO_2$) with CaO/SiO_2 = 1.3 are under investigation which is related to primary and intermediate BF slags. Over 400 experiments have been carried out in this system in equilibrium with metallic iron. The experimental plan for this sub-project has been modified following the preliminary experiments. Further experiments are under way by a PhD student.
- Formation of primary slag in the BF cohesive zone has been investigated using industrial iron sinter, pallet and lump to identify the composition of primary slag. These experiments will correlate the formation of primary slag to the components of the sinter such as "FeO", MgO, Al_2O_3 and CaO/SiO_2.
- Systematic studies including phase equilibria, viscosity and sulphur partitioning have been carried out to assist a plant trial in Baosteel to reduce MgO in BF slag. The work was required by the ironmaking plant in Baosteel and a report is in preparation. Success in reduction of MgO in BF will be of significant benefit to Baosteel.
- Phase equilibria in the system MgO-Al_2O_3-($CaO+SiO_2$) with CaO/SiO_2 = 1.5 have been experimentally determined to describe the bosh slag in Baosteel's blast furnaces. The experiments have completed and the draft of the paper is in preparation.

PROJECT ID BA12003

Project title

Performance of lubricant and rolling pressure characterisation

Project leader

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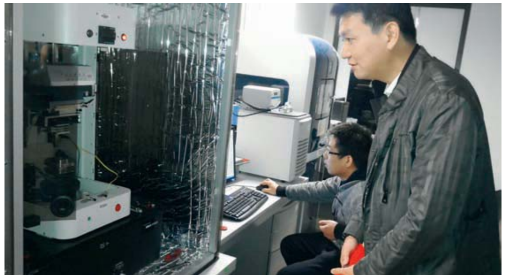
OBJECTIVES AND BENEFITS

This project will develop high-performance cold strip metal rolling technology by accurately characterising roll-strip interactions, including the effect of lubricant and lubricant additives on rolling pressure and performance. It aims to open a new pathway for revealing the mechanisms of rolling deformation in mixed lubrication, and find a feasible solution that enables high-performance rolling with superior precision and surface integrity. It will enable Baosteel engineers to develop new, high-performance rolling lubricant and processes that significantly increase the company's competitiveness.

HIGHLIGHTS AND ACHIEVEMENTS

June - December 2013

- A multi-scale analysis method for characterising the interface friction in cold rolling has been successfully established.
- Incorporated the microscopic asperity deformation and asperity/lubricant interaction and the macroscopic elasto-plastic deformation of the strip into the current friction model, in order to consider the influence of large plastic deformation of asperities on interface friction.
- Incorporated statistical analysis of elasto-plastic contact of rough surface into to the multi-scale model to predict the real contact area and contact stress in the rolling bite.



- Considered the elastic recovery of asperities undergoing large plastic deformation for the purpose of accurately predicting the surface evolution of rolled strip.
- Found that the properties of a lubricant can significantly change the interface friction behaviour, and the multi-scale model based on the elastic deformation of asperities could underestimate the real contact area at the contact interface.

January – June 2014

- Introduced an equivalent interface layer between the roll and strip interfaces to capture microscopic asperity deformation and asperity/lubricant interaction.
- Conducted a systematic finite element analysis out to predict the macroscopic bulk deformation of the strip.
- Found that the strain rate has a great influence on strip yielding stress.

PROJECT ID BA12011

Project title

Decrease of environmental impact of steelmaking: development of fluorine-free mould flux for steel continuous casting

Project leader

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Principal researchers

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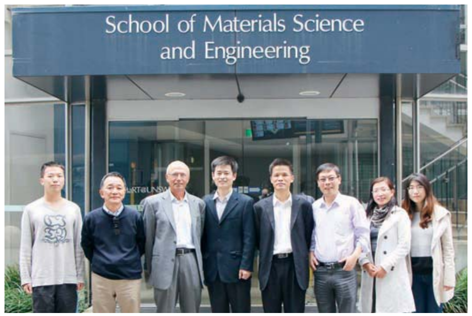
Ms Lin Wang
Mr Jian Yang

OBJECTIVES AND BENEFITS

This project aims to establish the scientific grounds for the development of fluorine-free boracic mould flux as an alternative to conventional fluorine-containing flux, and for use in industrial steel casting. It will study the melting properties, viscosity and crystallisation of fluoride-free mould flux and the extent of boron volatility in different fluxes. The project will research (i) crystal structure development and the precipitation process in boracic mould flux; (ii) the effect of B_2O_3 in the fluorine-free flux on the flux-metal reaction; (iii) the volatility of boron in boracic flux; and (iv)the wetting of non-metallic inclusions by the molten boracic flux. This research will lead to the design of a more environmentally-friendly, cost-effective fluoride free mould flux which will meet Baosteel's requirements for casting high-quality steel without surface defects.



HIGHLIGHTS AND ACHIEVEMENTS

July-December 2013

- Fluoride-free boracic flux melting temperature and viscosity measurement using a hemisphere method.
- Selection of F-free systems potentially suitable for mould fluxes for continuous casting.
- Conducted XRD and SEM/EDS analysis of F-free fluxes. Crystallisation of boracic fluxes: CCT diagram + phase analysis of quenched fluxes.
- Application of CLSM analysis to examination of solidification of F-free fluxes.
- FACTSage calculation of equilibrium phases.

January – June 2014

- Fluorine-free fluxes based on the matrix of CaO-SiO_2-Al_2O_3-B_2O_3 were designed using FACTSage thermochemical modelling.
  - Single and double hot thermocouples (SHTT and DHTT) have been commissioned to study flux crystallisation and will be used for fluoride-free mould fluxes. These techniques have been tested in application to Baosteel mould flux for continuous casting of low carbon steel.
  - Constructed CCT and TTT diagrams.
  - Examined crystal phases of quenched flux using x-ray diffraction.

PROJECT ID BA12014

Project title

Competitive 6xxx series aluminium automotive body panel sheet materials with improved formability

Project leader

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OBJECTIVES AND BENEFITS

This project will address the current formability shortcomings of 6xxx series aluminium alloys by focussing on alloy and process design, with an emphasis on specialised cold rolling, heat treatment and alloy composition. It will conduct strategic research leading to the next generation of high formability 6xxx series aluminium alloys for use in exterior and interior automotive body panel applications. Modelling and experiments will deliver a thorough understanding of 6xxx alloy sheet formability, and propose novel alloy-process combinations that deliver better formability than existing benchmark alloys with no degradation of bake-hardening properties. It will provide Baosteel with alternative solutions to customer demands for lighter weight alloys for use in its automotive businesses.

HIGHLIGHTS AND ACHIEVEMENTS

September 2013

- Identify new 6xxx compositions.

December 2013

- Evaluate benchmark alloys.

March 2014

- Completed the microstructure process model framework.

June 2014

- Perform cold rolling and heat treatment of 6xxx alloy materials.
- Produced small scale alloy samples for nine of the identified alloy compositions.
- PhD candidate Yuan Wang visited Baosteel to continue benchmarking forming limit testing, which was an extremely valuable exercise.

PROJECT ID BA12029

Project title

Novel approach to grain refinement for continuous casting and ingot casting of steels

Project leader

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Principal researchers

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OBJECTIVES AND BENEFITS

The project aims to improve the quality of steel products by refining their grain size, decreasing porosity, eliminating macro-segregation, columnar structure and transverse cracks. It will apply well-established crystallographic and independence grain refinement theories used for processing light metals to develop novel and effective grain refiners for the continuous and ingot casting of steels. Its research tasks include: (i) identification of new and effective grain refiners using the E2EM model and its associated database; (ii) validation of the predicted grain refiners in steel casting; (iii) development of grain refining master alloys to be added during continuous and ingot casting; and (iv) verification by industrial-scale trials conducted at Baosteel. It will create new products such as patented master alloys for use in the grain refinement of steels, opening up new business opportunities.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

– Identified potential grain refiners.

– Made progress on the grain refinement studies and the understanding of the hot cracking behaviour.

January - June 2014

– Completed initial validation of the grain refiners.

– Completed validation in a continuous casting process.

– identified and verified the addition of Cu can significantly refine the as-cast grains and increase the fraction of equaxed grains of Baosteel H1 steel.

– Verified TiN as an effective grain refiner for Baosteel M1 steel from the computational results of crystallographic calculation using the edge-to-edge matching model.

PROJECT ID BA12031

Project title

The next generation protective conversion coatings for Mg alloys

Project leader

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Principal researchers

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Mr Chong Ke (PhD candidate)
Prof. Nick Birbilis

OBJECTIVES AND BENEFITS

This research project aims to develop a cost-efficient, environment-friendly alternative method of producing practical chromium-free conversion coatings that actively protect Mg alloys from corrosion. It will develop a novel protective surface coating system for Mg alloys by: (i) Developing a series of pre-treatment processes to achieve a favourable intermetallic-free surface of Mg alloys for subsequent conversion film growth; (ii) Building appropriate condition windows using computed forms of equilibrium thermodynamic calculations to produce desirable Mg alloy coatings; (iii) Applying a protective metal phosphate conversion coating to provide Mg alloys with the functionality to meet the needs of different end users; and (iv) Testing the corrosion resistance of such coated Mg alloys under service conditions. It promises to significantly transform the Mg alloy market by enabling industry to use these alloys to produce lightweight metal parts for energy-efficient transportation vehicles.

HIGHLIGHTS AND ACHIEVEMENTS

October 2013

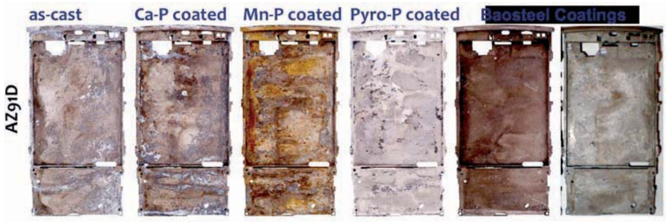
– Developed a new pre-treatment process to remove the foreign phases from Mg alloys invented by BaoSteel.

June 2014

– The newly developed pre-treatment approach has been further optimised for the Mg alloys invented by Baosteel, to meet the requirements for scale-up implementations.

– Over the past 6 months, the research has reduced the experimental alloys' pre-treating time from 4 hours down to 20 mins, which is getting closer to the ultimate goal, i.e. 5-10 mins.

– Established a Baosteel accepted corrosion testing protocol, to provide direct evidence and evaluation of corrosion performance of newly developed Mg alloys and coating technology.



PROJECT ID BA12035

Project title

Significance, measurement and control of centreline segregation in continuously cast line pipe steels

Project leader

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Mr. Jianlan Shen
Mr. Liqiang Fan
Prof. Guodong Xu
Mr. Guangzheng Gui

OBJECTIVES AND BENEFITS

This project targets new advanced steel-making technologies to improve the quality of continuously cast steel. By comprehensively evaluating current techniques used to assess and quantify centre line segregation, it aims to establish a simple prototype computer vision-based segregation evaluation method. Acceptance criteria will be based on and validated against the Mannesmann Scale. The project will also produce a draft internal Standard Operating Procedure for Baosteel. This research has great potential to improve Baosteel's market share, product quality and reputation as a supplier of high-strength steel pipe to the international pipeline industry.

HIGHLIGHTS AND ACHIEVEMENTS

July 2013 – Dec 2013

- Calculated the segregation level for the five Mannesmann charts which was based on certain rules from experts' experience at steel factories around the world.
- Developed three equations to relate segregation severity and macrostructure images. The segregation severity fits well with the Mannesmann charts.

January 2014 – June 2014,

- Conducted a literature review on pipeline industry experience or incidents involving segregation problems in the continuously cast products.
- Planned a series of experiments in order to find out the influence of segregation severity on the properties of line pipe products.
- Developed a prototype expert computer program based on image analysis to evaluate the images of centreline segregation by automatic measurement of segregation features, still under further improvement.
- Applied both previous and new rules (gleaned from several experienced steelmakers) to evaluate the standard Mannesmann images and some real segregation images obtained from Baosteel. The evaluation results are well aligned with the results evaluated from conventional methods.

PROJECT ID BA12045

Project title

Advanced modelling and experimental investigations of wear mechanism of high-speed steel hot rolls

Project leader

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Dr Qiang Zhu
Prof. Dale Sun
Dr Qun Fan
Dr Qiong Wu

OBJECTIVES AND BENEFITS

This project aims to achieve a theoretical and technological breakthrough that will enable steel manufacturers to predict abrasive roll wear performance in the production of multi-phase high-speed steels (HSS) at high temperatures. It will systematically investigate the oxidation and mechanism of HSS roll in practical hot rolling conditions, using an integrated approach involving new experimental set-ups, advanced computational modelling, and material characterisation techniques. It will provide practical solutions to: (i) the promotion of the effective oxide scale 3-5 μm in thickness on HSS roll with less warm-up coils; (ii) characterisation of the oxide and wear failure of HSS roll in service; (iii) prediction of transverse HSS roll in terms of thermal expansion and wear; and (iv) guidelines for optimum roll regrinding. The project promises to improve the production quality of HSS steel rolls and reduce the costs of roll wear.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- Designed the experimental methodology to study the oxidation behaviour of the high-speed steel work roll materials.
- Completed a numerical model to predict work roll profile with consideration of thermal expansion and wear. The model can determine the steady state work roll temperature and thermal expansion/crown as well as the wear profile according to the actual rolling schedule of Baosteel hot strip mill.

January – June 2014

- Accomplished the characterisation of oxidation behaviour of HSS roll material provided by Baosteel. The results show some similarity with our previous tests on our HSS samples.
- Completed the nano-indentation tests on the polished HSS samples at the room temperature, and proceeding with nano-indentation tests on HSS samples at elevated temperatures. The results of high temperature nano-indentations will provide important information for the study of wear mechanism of HSS rolls in hot rolling process.
- Developed a thermal FEM model to predict temperature evolution on the cross-section of work-roll based on a number of coils in a rolling schedule during the hot strip rolling process. It leads to a prediction of the built-up of the oxide scale thickness through the kinetics of scale formation with temperature and time.
- The growth behaviour of oxide scales and the response of HSS samples subjected to high frequency thermal cycles has been determined.

PROJECT ID BA12053

Project title

Advanced nanocrystalline/amorphous heterostructural Fe-based soft magnetic materials for high performance electric motors

Project leader

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Principal researchers

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Dr Kevin Laws

OBJECTIVES AND BENEFITS

This project is directed at the experimental and theoretical development of advanced Fe-based nanocrystalline alloys with optimised soft magnetic properties, which can be used to manufacture high-performance, energy-efficient next-generation electrical motors, generators and transformers. It will employ a novel concept of specific element doped nanocrystalline/amorphous heterostructures to produce Fe-based nanocrystalline alloys which have saturation magnetic flux density Bs > 2.0 Tesla, coercive force Hc < 1.0 A/m, to improve the engineering of high-performance Fe-based soft magnetic materials with high control and reliability. Advanced Fe-based nanocrystalline alloys with low energy loss and high permeability have great potential as replacements for the silicon steels now used in electric motors.

HIGHLIGHTS AND ACHIEVEMENTS

July – December 2013

- The results of the experiments demonstrated that a fundamental principle could be provided to control the microstructure of Fe based soft magnetic alloys for Baosteel.

January – June 2014

- Experimental results have demonstrated that the coercive force can be finely controlled by optimizing the annealing parameters under glass-transition temperature.
- Developed standard approaches to measure the mechanical properties of amorphous/nanocrystalline alloys with the aid of our nano-identification facilities.
- Designed and fabricated a series of high performance amorphous alloy ribbons at Baosteel which outperform the benchmark (Hitachi) products.

PROJECTS AND OUTCOMES – ROUND 3

PROJECT ID BA13005

Project title

Smart polymer hydrogels for simultaneous waste heat utilisation and wastewater treatment for steel industry

Project leader

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Principal researchers

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OBJECTIVES AND BENEFITS

This project proposes to develop dual-functionality, temperature-responsive polymer hydrogels as draw agents for continuous forward osmosis wastewater treatment process, using low–and-medium temperature waste heat as a green input into the process. This new technology will significantly reduce the costs of wastewater treatment, and thus fresh water consumption, whilst effectively utilising waste heat generated in the steel manufacturing process. The outcomes of this research will provide a unique opportunity for Baosteel to become a world leader in the rapidly-emerging, energy-efficient forward osmosis technology and produce significant economic and environmental benefits for the steel industry.

HIGHLIGHTS AND ACHIEVEMENTS

January 2014

- Project commencement.

June 2014

- Synthesis and characterisation of dual-functionality, temperature-responsive hydrogels.
- Interim results show that the length scales of two interpenetrating polymer phases greatly affect the water absorbing and dewatering properties of the draw agents.
- An Australian Research Council linkage application (two PIs from Baosteel: Drs Hongjuan Hou and Shunhua Xiang) was submitted in November 2013, and this linkage project received $450,000 funding from the ARC (announced on 27 June 2014).

PROJECT ID BA13012

Project title

Development of novel nano-additive water based lubrication technology for hot rolling of steels

Project leader

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Principal researchers

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Dr Yang Bai

OBJECTIVES AND BENEFITS

This research project aims to develop novel nano-additive water based lubricants which would improve rolled steel product quality, reduce resources utilisation and be environmentally friendly and cost effective. The outcome will have significant implication in the current steel production industry. It will be beneficial to the improvement of product surface quality by reducing rolling force and roll wear, and particularly valuable to the hot rolling of ultra-high strength steels where high rolling force and wear prevail.

HIGHLIGHTS AND ACHIEVEMENTS

February 2014

- A postdoctoral fellow, Dr. Yang Bai, was recruited and commenced his work. Two PhD students (from UQ and UOW) have been working full-time on the project.

June 2014

- Literature review was completed.
- The experimental plan was discussed in details between the three parties involved in the project.
- Fundamental investigation of the interfacial adhesion of oxide scale/steel system has commenced.
- Samples for testing lubrication performance were designed and fabricated in Baosteel.
- The detailed testing methodology on physicochemical properties of lubricants was validated based on the international standards.

PROJECT ID BA13014

Project title

Study on processing quality and precision of non-uniform AHSS products fabricated with chain-die Forming

Project leader

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Principal researchers

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A/Prof. Huijun Li

OBJECTIVES AND BENEFITS

The project is to study a new way to manufacture the non-uniform profiled advanced high strength steel (AHSS) parts of motor vehicles. The proposal will solve the bottom neck problem of AHSS from a flat sheet to a final product, currently a limiting factor to wider application. The solution will dramatically increase the usage of high grade AHSS on motor vehicles and other application area. This will directly increase the sales of Baosteel AHSS materials and position Baosteel as a leader in AHSS manufacturing and application to automotive industries.

HIGHLIGHTS AND ACHIEVEMENTS

June 2014

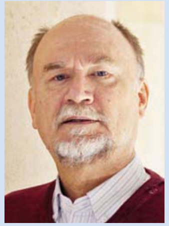
- Literature review of forming processes for non-uniform profiled products, and the characteristics and applications of each process.
- The analytical aspects of the research is continuing and partially completed.
- The margin strain of the critical points during forming have been analysed and the margin strain will be used to inform material selection in the product design stage. The results from the theoretical formula will also be useful to understand the forming principle and in directing industrial practices.
- The relationships among the axial strain, the flange height, the curve radius and the bend radius are also being analysed and summarised.

PROJECT ID BA13037

Project title

The influence of hydrogen on steels for auto construction

Project leader



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Principal researchers

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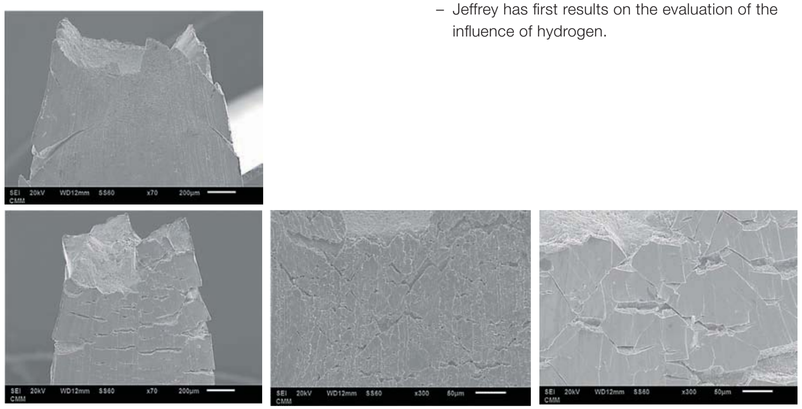
Prof. MingXing Zhang

OBJECTIVES AND BENEFITS

This project aims to assess the influence of hydrogen on auto steels and recommend improvements leading to improved hydrogen embrittlement resistance. The outcome of this project could help Baosteel to produce automobile steels with higher resistance to hydrogen embrittlement than major competitors, and develop capabilities in the newest hydrogen embrittlement assessment methodology.



HIGHLIGHTS AND ACHIEVEMENTS

January 2014

- Project Commencement.

April 2014

- Specimen material of the steels to be studied have been received from Baosteel.
- PhD students (Jeffrey Venuzuela and Qinglong Liu) commenced 1 April 2014.
- Jeffrey and Qinglong have undertaken inductions and training in optical metallography, scanning electron microscopy (SEM), linearly increasing stress tests (LIST), permeation experiments.
- The literature reviews have commenced.
- Qinglong has commenced permeability experiments.
- Jeffrey has first results on the evaluation of the influence of hydrogen.

PROJECT ID BA13051

Project title

Development of CZTS thin film solar cells on Baosteel stainless steel for BIPV application

Project leader

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OBJECTIVES AND BENEFITS

The significantly growing market share of stainless steel for building construction as roofing, skin and facades motivates its application in Building Integrated Photovoltaics (BIPV), by integrating photovoltaic power generation into sunlight exposed building stainless steels. The aim of this project is to work with Baosteel to exploit the technologies of copper-zinc-tin sulphide (CZTS) solar cells on Baosteel hard/flexible stainless steel for BIPV applications, using technologies compatible with existing commercial equipment options for high-volume production and strategies for system integration into buildings. The measurable target is to increase the CZTS cell efficiency to beyond 10% and ultimately approach 20% at lower cost. This project will place Baosteel in a position to access a significant share of the BIPV market and make Baosteel stainless steel specialty products more competitive.

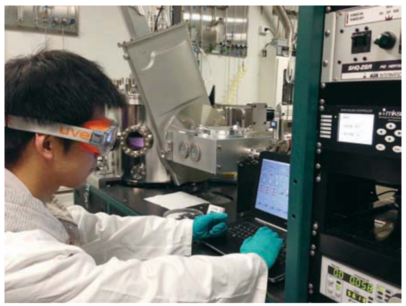
HIGHLIGHTS AND ACHIEVEMENTS

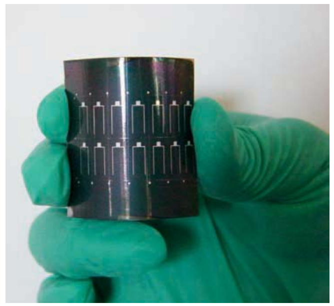
January 2014

- Confirmed the demands on CZTS flexible substrate.

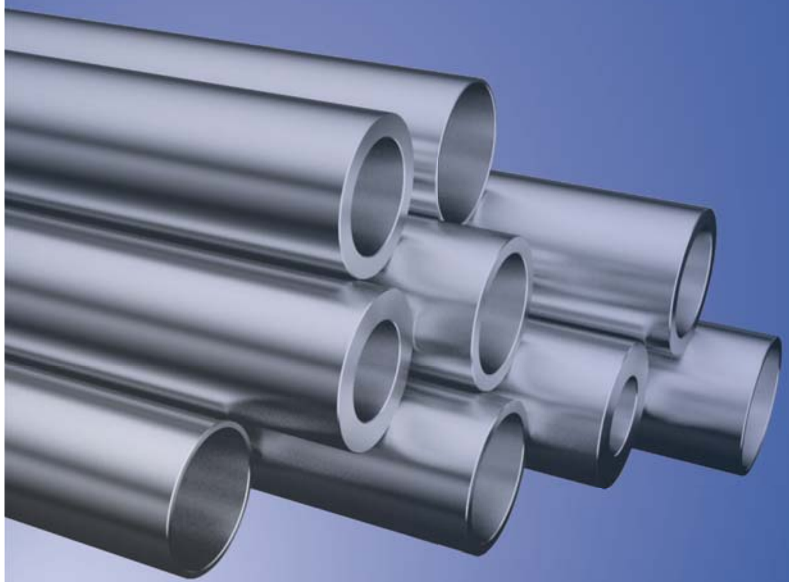
June 2014

- Ranked stainless steel types for hard/flexible CZTS based solar cells.
- Confirmed the demands on using Baosteel enameled steel.





publications



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financial report

FINANCIAL STATEMENT FOR THE PERIOD FROM 01 JULY 2013 TO 30 JUNE 2014

BAJC Grantors:
- Baoshan Iron & Steel Co Ltd (Baosteel)
- The University of Queensland
- The University of New South Wales
- Monash University
- University of Wollongong
- Australian Research Council (ARC)
- The Cooperative Research Centres (CRC)

Cash Balance as at 30-06-2013		**$2,599,151.01**
INCOME (CASH)		
Grant and Collaborative Research		
	Baosteel R & D Fund (Round 3 – Year 1)	$700,000.00
	Baosteel R & D Fund (Round 2 – Year 2)	$1,170,000.00
	Baosteel R & D Fund (Round 1 – Year 3)	$1,460,000.00
	Baosteel - management support	$250,000.00
	The University of New South Wales – management support	$50,000.00
	Monash University – management support	$50,000.00
	University of Wollongong – management support	$50,000.00
	The University of Queensland – management support	$100,000.00
	Total Cash Income	**$3,830,000.00**
	Total Leveraged **ARC-Linkage Grant**	$515,000.00
	Total Leveraged **CRC Grant**	$250,000.00
TOTAL INCOME (EXCLUDING IN-KIND)		**$4,595,000.00**

FINANCIAL STATEMENT, 01 JULY 2013 – 30 JUNE 2014 (CONTINUED)

EXPENDITURES

Grant and Collaborative Research		
	Payment in **cash** to collaborative approved projects[1]	$2,816,750.00
	Allocated **ARC Linkage Grant**	$515,000.00
	Allocated **CRC Grant**	$250,000.00
	Total Grant and Collaborative Research Expenditures	**$3,581,750.00**
Baosteel Centre – Management		
	Personnel – Salaries	$299,690.72
	Staff Develop & Health Cost	$572.00
	Consumables (stationery, printing)	$4,546.67
	Services (Professional consultancy)	$1,735.00
	Marketing & Advertising	$242.63
	Equipment for Office	$6,457.78
	Telecommunications	$848.09
	Travel and Hospitality[2]	$50,182.43
	Financial costs & taxes	$2,098.97
	Total Centre Management Expenditures	**$366.374.29**
TOTAL EXPENDITURES (INCLUDING GRANT & RESEARCH FUND ALLOCATION)		**$3,948,124.2**
Operating Result[1]	**Cash Balance as at 30 June 2014**	**$3,246,026.72**

*Note:
1) Cash balance includes cash funds to be paid to the approved projects in second half of calendar year 2014.
2) Travel and Hospitality include partial costs associated with TAC and Board meetings.

Accumulative Fund Distributions to each University

Participating Universities	2011-2012	2012-2013	2013-2014	Total
Monash University	$300,000	$660,000	$645,000	$1,605,000
The University of New South Wales	$250,000	$609,000	$881,750	$1,740,750
The University of Queensland	$175,000	$470,000	$860,000	$1,505,000
University of Wollongong	$225,000	$585,000	$430,000	$1,240,000
Grand Total	**$950,000**	**$2,324,000**	**$2,816,750**	**$6,090,750**

IN-KIND FOR PROJECTS

Partnership In-kind for Research Projects 2013-14	
Baosteel	$1,132,171
Monash University	$1,398,361
The University of New South Wales	$1,392,810
The University of Queensland	$1,708,070
University of Wollongong	$1,053,235
Total In-kind Contribution	**$6,684,646**

Centre Board

The Centre Board is responsible for setting priority and strategic research themes, annual budget, funding rules, approval of project funding. It will provide guidance and oversight to the Centre management team.

The Centre Board consists of 9 representatives, comprising a Board Chair appointed by Baosteel, a Board Co-chair appointed by the University of Queensland, 4 members from Baosteel including the Board Chair, 2 from UQ including the Co-Chair and the Centre Director, and 1 each from other Participating Institutions. The Centre Deputy Director, who serves as the Centre Board Secretary, and Chair of the Technical Advisory Committee (TAC), have observer status.

Professor Jinghai Li
Board Chair
Vice President of Chinese Academy of Sciences (CAS)
Institute of Process Engineering (IPE), CAS, Beijing, China

Professor G.Q. Max Lu
Board Co-Chair
Provost and Senior Vice-President
The University of Queensland

Dr Pijun ZHANG
President of Baosteel Research Institute (R&D Centre)
Baoshan Iron and Steel Co. Ltd

Professor Judy Raper
Deputy Vice-Chancellor (Research)
University of Wollongong
Executive Director, Australian Institute of Innovative Materials

Professor Victor Rudolph
Centre Director
School of Chemical Engineering
The University of Queensland

Professor Freider Seible
Dean, Faculty of Engineering
Monash University

Dr Warwick Dawson
Director of Research
University of New South Wales

Dr Laizhu Jiang
Senior Engineer
Assistant President of Baosteel Research Institute (R&D Center)
Baoshan Iron and Steel Co. Ltd

Dr Jian Yang
Senior Engineer, Baosteel Research Institute (R&D Center)
Baoshan Iron and Steel Co. Ltd

Professor Aibing Yu
Federation Fellow and Scientia Professor
Board Observer
Chair of the Technical Advisory Committee (TAC)
University of New South Wales (as of June 2014)

A/Professor Geoff Wang
Board Secretary
Centre Deputy Director
School of Chemical Engineering
The University of Queensland

Technical Advisory Committee

The Technical Advisory Committee (TAC) consists of a Chair, 4 internationally recognized Australian based academics and experts recommended by the Participating Institutions and approved by the Centre Board, and 4 technical liaison advisors appointed by Baosteel. The Chair of the TAC was jointly nominated by Baosteel and UQ and approved by the Centre Board. The main role of the TAC is to conduct technical assessments on the research proposals and makes recommendations for funding to be approved by the Centre Board.

Professor Aibing Yu
Federation Fellow and Scientia Professor
TAC Chair
School of Materials Science & Engineering
University of New South Wales

Dr Pijun Zhang
President of Baosteel Research Institute (R&D Centre)
Baoshan Iron and Steel Co. Ltd

Professor Shi Xue Dou
Faculty of Engineering
Director, Institute for Superconducting and Electronic Materials
University of Wollongong

Professor Ian Gentle
School of Chemistry and Molecular Biosciences
The University of Queensland

Emeritus Professor David Young
School of Materials Science and Engineering
University of New South Wales

Professor Yuri Estrin
Department of Materials Engineering
Faculty of Engineering
Monash University

Professor Xinhua Wu
Department of Materials Engineering
Faculty of Engineering
Monash University

Dr Laizhu Jiang
Senior Engineer
Assistant President of Baosteel Research Institute (R&D Center)
Baoshan Iron and Steel Co. Ltd

Dr Jian Yang
Senior Engineer
Baosteel Research Institute (R&D Center)
Baoshan Iron and Steel Co. Ltd

Management Team

The management team, comprising the Director (50% full time equivalent), a Deputy Director and an Director Assistant, is responsible for project call-for-proposals, project coordination and facilitation, project meetings, reporting, budgetary management and IP management. It provides reporting and secretariat services to the Centre Board, including organizing Centre Board meetings and documentation. The management team of the Centre is also responsible for organizing the meetings of the Technical Advisory Committee and Centre annual conference, website and hosting visits from Baosteel personnel. A Baosteel coordinator also participates in the Centre management.

Professor Victor Rudolph
Centre Director
The University of Queensland

A/Professor Geoff Wang
Centre Deputy Director
The University of Queensland

Ms Wendy Zhang
Centre Operations and Finance
The University of Queensland

Mr Yongzhu Ma
Baosteel Coordinator Research Engineer, Baosteel Research Institute (R&D Center) Baoshan Iron and Steel Co. Ltd

CONTACT DETAILS

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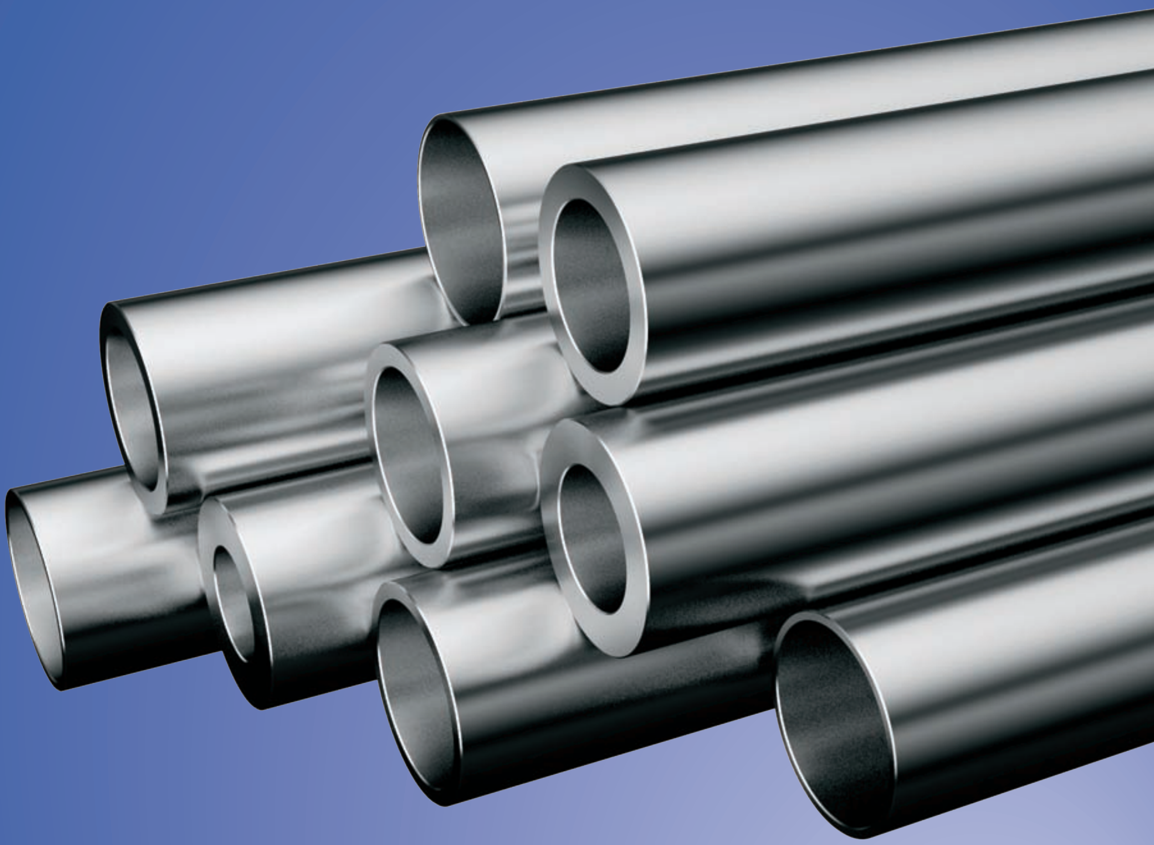

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