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# **ALUMINIUM CAST HOUSE TECHNOLOGY**

Theory & Practice

**EDITED BY**  
**M. Nilmani**

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# **ALUMINIUM CAST HOUSE TECHNOLOGY**

## **Theory & Practice**

This International symposium was staged by the G.K. Williams Cooperative Research Centre of the Department of Chemical Engineering, University of Melbourne and was held during 4 - 8 July, 1993 at the University of Melbourne in Melbourne, Victoria, Australia.

Edited by  
Madhu Nilmani



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# **ALUMINIUM CAST HOUSE TECHNOLOGY**

Theory & Practice

## **PREFACE**

This International Conference follows the two previous very successful Conferences held in Melbourne, Australia in 1989 and 1991. The continued support of the aluminium industry and related companies helped to attract well renowned key experts around the world in the area of molten metal treatment and casting to address the key issues faced by the Aluminium Cast Houses. The high quality of the contributions at these Conferences and the increasing demand for the proceedings has motivated us to publish this conference volume through TMS for wider circulation.

All the papers in this volume are from invited speakers and address the challenging issues industry faces in technology management, productivity, and environment.

The editor and the organising Committee would like to thank the authors for providing valuable information contained in this book and to the Minerals, Metals & Materials Society for its publication. The editor is also grateful to the companies who through their co-operation and enthusiasm made this Conference possible.

Madhu Nilmani  
Conference Chairman  
G.K. Williams Cooperative Research Centre  
University of Melbourne, Australia

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# **FUTURE TRENDS MANAGEMENT ISSUES MELT TREATMENT**



## WHERE THE AUSTRALIAN ALUMINIUM INDUSTRY IS HEADING

Karl W. Stewart

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This address seeks to confront the problem of delivering significant change in a mature industry.

It calls upon data from a plant which has been in operation for 20 years in an internationally competitive industry and shows that significant improvement is possible.

Drawing from the field of chaos it argues that we have no choice but to fully utilise the creative capability of all of the people who work in an enterprise as the human intellect is the only mechanism available to us which is able to deal in real time with a chaotic environment.

Aluminum Melt Treatment & Casting  
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It has been my experience that keynote addresses are usually either predictions based on past trends, and these predictions are always wrong, or collections of homilies and platitudes which sometimes cause everyone to feel good but which are of no practical use apart from producing the transient high.

With that opening I have clearly set myself the task of trying to do neither of these things.

I am supposed to be talking about where the Australian aluminium industry is heading, the short answer to this, if I cast it as a question, is that I do not know.

What I do know is that the Australasian aluminium industry will go wherever the people who lead it, and the nations in which it operates, allow it to go. Given that this industry is located close to a rapidly growing market, that it has an established infrastructure, a sound raw materials base, and given too the technical development of the population group in which it is embedded this industry should do reasonably well, it might even do brilliantly. However it would not take very much in the way of misguided differential taxation of one form or another imposed by inept Governments to make the industry's life thoroughly miserable even if it was not dealt a mortal blow.

I know I do not have to convince you there is no shortage of inept governments around the world.

On the assumption that the industry will not be reduced to the state of financial ill health that gradually destroys it, I think we will see a growing demonstration that, as an industry, it accepts that it must markedly improve its quality if it is to prosper.

I do not use this all encompassing term 'Quality' loosely, I refer to quality in all aspects of the industry's endeavours and not just the quality of its output, its overall technical efficiency or its cost effectiveness.

Most importantly the aluminium industry must learn to be a high quality user of the creative abilities of all its people. The industry is not doing this at present.

This statement sounds very much as though it fits into the homily and platitude category, let me see if I can move away from here.

In order to do this I wish to digress for a moment to a newly developing field of mathematics, the field of chaos. I believe the mathematics of chaos has been insufficiently well appreciated by those persons whose work it is to manage and lead the enterprises of nations. I believe the startling, yet in some ways comforting, insight which this field of mathematics has brought to us is the knowledge that in most human endeavours we need no longer spend our emotive and material energies in the search for the holy grail of deterministic equations which will allow us to predict the future of the complex processes with which we must work.

We do not live in a deterministic world wherein a knowledge of our present state and a set of equations allows us to predict the future with accuracy. We live in a world which is naturally chaotic.

The development of the mathematics of chaos has finally closed the door to our escape into the field of excuse and wistful longing which determinism allowed.

We need to face squarely the reality that our everyday work requires us to excel in this unpredictable world of complex patterns and recognise that such work is the particular preserve of the human mind. We need to behave in a way which demonstrates the reality that the human mind is the only instrument which has the ability to cope in real time with non-deterministic variation.

I referred earlier to comfort, this may seem odd in the context of which I speak but I believe the comfort comes from no longer having to feel guilty about being unable to predict accurately the outcome of the process, be it a technical process or a human process. Free of guilt we may roll up our sleeves and get on with the truly productive work of the enterprise. In setting out then to do this we are patently foolish if we do not use the full capability of all the human minds in our employ given that the human mind is the only viable tool available to us.

I accept that the requirement to fully utilise all the human minds we employ does throw us back to a more difficult philosophical construct than that with which we have become comfortable. This is the construct of having to accept that the sole reason for paying all the people of the enterprise, leaders, producers, managers of resources, and advisers on technique is that they must make judgments, for these are the product of human minds at work. We may no longer pay for time spent or widgets in the box which is what we have been doing for centuries.

Our people in our industry must make judgements because there can be no certainty, their worth to the enterprise must be assessed on the quality of those judgements. In a greater or lesser time all of these judgements will be tested, some will be proven and some found wanting.

But then that is life, isn't it?

We are free will engines, embedded in an evolutionary chaos, our survival is utterly dependent upon our ability to make sound judgments so we are able to compete with the variability of the environment as individuals and as social groups.

It would be understandable if by this stage you are beginning to wonder what the hell all this has to do about cast house technology or, for that matter, about aluminium!

It is said that great art mirrors life more truly than life itself, so let it be with keynote addresses. Let me try to bring into a pattern the pieces of this particular chaos.

The aluminium industry is one of the few in Australasia which is large enough to carry change processes through time and which has had to compete on the international scene for a long time. The aluminium industry has not been coddled and rotted by Government subsidy drawn from the sad and shrinking purse of the taxpayer. Each market downturn makes it very clear to every aluminium producer company that its efficiency and cost of production is of crucial importance if it is to survive. We should therefore expect aluminium companies to be an excellent hunting ground if we are to search out the very best methodologies for the management and leadership of change.

As the world becomes the one market for produce and knowledge, the ability to lead change, to thrive in chaotic circumstances, is becoming more and more the sole criteria for corporate and national well being.

And the management and leadership of change is after all merely making judgements to keep the enterprise prosperous in a chaotic environment.

If the Australasian aluminium industry is going to go anywhere at all it will take advantage of the excellent learning opportunity delivered to it by market downturns like the one we are in now even though these are desperately painful.

So having established the linkage between the aluminium industry and the mathematics of chaos, now to cast houses.

Because we are dealing with a chaotic environment we cannot deterministically predict using formulae derived from the data of history but we do know that the data of history can, if the process is chaotic, through a determination of its past patterns give us a sound guide as to what patterns we might expect in the future. From Deming and others we have the language of common cause of variance and the language of special cause. In simple form these are the predictable patterns of a truly chaotic environment. We can, and must, use this information to inform our judgement.

If the Australian aluminium industry is to become competitive in the real sense of the word, it has no option but to have all of the people who lead it, manage its resources, and make its products rely upon data, and the patterns demonstrated in the data, as they go about their work of making judgement. We must seek out and use genuine data and not hearsay - we must follow the discipline of law and science.

Do I hear the technically literate in my audience heaving a sigh and thinking "Oh Lord! another bloody lecture about TQM". Well, for those of you who have so responded, you might consider the following question : "Why is it that quality management was invented in the USA but in a broad sense, works only in Japan? What makes you think it will work in Australia?"

Come back next week for the answers.

Classical quality management does concentrate on the process, but emphasises the technical process, although there is importance given to the human processes which surround these. One has only to read Deming to appreciate this. The methodologies of application concentrate upon the technical processes.

I would suggest to you that in all Australasian industry the most significant gains in cost efficiency and product effectiveness can be achieved through changing the human process alone and by so doing producing a working environment which satisfies the creative need of people. I accept that attendant to such a change in the human process the people who are embedded in the change will in turn cause change to the technical processes which surround them.

I suggest to you that to a very large extent, what we have been trying to do in our genuine attempts to introduce total quality management into Australian industry is akin to moving a piece of cooked spaghetti by pushing it rather than pulling it.

In some areas we will gain a modicum of success because the very activity of gathering data and talking with people to gain an understanding of a technical process does sometimes change the surrounding human process for the better and the outcome of the combination is a genuine improvement.

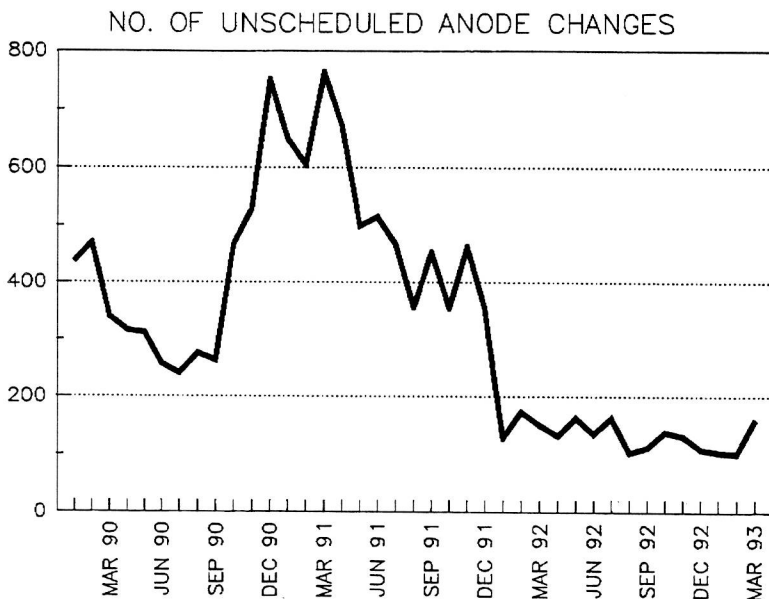
Sometimes things get worse.

The gains we have seen in Australia from this methodology of attacking the technical processes have been modest.

In too many cases we have invested huge capital sums to change a technology when this was unnecessary.

It is now time for me to put up or shut up. I talked earlier about data. I would like to show you some.

Here is a run chart of unscheduled anode changes.





The chart speaks for itself. There is no change in technology underlying the manifest change in this data, there are undoubtedly some subtle process changes but these were not achieved as a result of total quality management but rather were achieved by good people being allowed for the first time, to do the good work, which they were always capable, and so achieving the satisfaction they have always sought and so rarely found at work.

Here is some data from a cast house showing a variety of measures.

