Preface

HEAT TREATMENT AND SURFACE ENGINEERING AS A BASIC DISCIPLINE OF METALLURGY

Heat treatment of metals dates back to ancient times. The apparently advanced ways employed for the making of Damascener and Samurai swords serve as examples. In this sense the innovation of the blast furnace by Darby, in the 18th century, and the discovery of the "martensite" structure named after Martens, a century ago, can be considered as (only) modern developments. These technological advances all pertain to steel. The breakthrough for aluminium as a major material was realized also "recently", in the beginning of this century, with the development of age-hardened aluminium alloys as "duraluminium".

The dynamics of the solid state, on the basis of thermal activation, never fail to fascinate the scientist, physical metallurgist, in his struggle to unravel the operating basic principles. Our society enormously stimulates such researchers by providing the necessary funds. Obviously, a principal cause for this generosity is the technological crop expected by this irrigation, as suggested by the above paragraph. Here it should be realized that the great developments in the field of heat treatment of metals are invariably due to a more or less direct interaction of scientist and engineer. This does not imply that their actual cooperation was and is usual.

In the past, in many cases practical development was clearly ahead of scientific understanding, although sometimes the reverse occurred. Nowadays it appears that more intensive interaction of laboratory research and practical application is in order, particularly because new methods of structural investigation allow understanding, in unprecedentedly detailed way, of basic principles involved. Thus tuning the properties of the products by optimizing the process parameters becomes feasible. So, a meeting ground for scientists and engineers working in this discipline is in order.

To meet the ever increasing demands, design of materials of increasing quality appears required. However, the development of new *bulk* materials can be an extremely costly enterprise. In many cases the *surface* of a workpiece is subjected most severely to external loads (e.g. corrosive agents, stress). Hence, surface treatments bringing about an upgrading of the quality of the surface adjacent material of workpieces can be very attractive. This led to the emergence of **Surface Engineering** as a separate field. Prominent and relatively old branches thereof are thermochemical processes as carburizing and nitriding, while recent and becoming increasingly important facets are processes based on physical and chemical vapour deposition.

The fragment of a historical sketch given here illustrates hopefully the interwoveness of (the older) Heat Treatment and (the newer) Surface Engineering. For both fields it holds: atomic mobility leading to phase transformations, as induced by supply of heat, is essential;

the properties generated should allow the practical application sought for and the same allied persons, i.e. scientists and engineers, are active in the combined fields. Against this background the occurrence of a conference on Heat Treatment and Surface Engineering is appropriate.

Without any intention to ignore any significant contribution, I may perhaps state that a principal activity in the area concerned occurs in Europe. Therefore it is fitting that a European Conference on Heat Treatment and Surface Engineering has been organized. The large attendance and participation in Amsterdam (22^{nd} - 24^{th} May, 1991) illustrates that Europe provides a focus for the field.

Considering the contents of the proceedings one may say that the really new scientific and technological developments involve: (i) the substitution of phenomenological knowledge, often inherited from a long past, by fundamental insight on the structure - property relations (example: nitriding and nitrocarburizing); (ii) the modelling and control of various processes as, in particular, the classical quenching and tempering and the thermochemical processes; (iii) the emergence of dedicated surface treatments, as those based on ion beams and the numerous ways for physical vapour deposition and (iv) the rise to maturity of vacuum and plasma technology including the application of (atmosphere) sensors of various kinds.

I have been active in this discipline since 1978, coming from a "world" dominated by "pure" science. It has been one of the most rewarding, fruitful experiences of my life until now, to perform and conduct research at the interface of science and technology, thereby communicating with both scientists and engineers. Others have felt similarly. I hope these proceedings give a reader the similar flavour as well as a useful survey of ongoing activities.

E.J. Mittemeijer

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Delft, The Netherlands

Editorial Notes

The papers have been arranged in each chapter in an order primarily on the basis of logic of the sequence.

Although I fully appreciate the symbiosis of science and technology in the discipline Heat Treatment and Surface Engineering (see "PREFACE"), to my disappointment I had to refuse a number of manuscripts which lacked sufficient quality. In particular it should be realized that papers in these proceedings can not be merely commercial pamphlets (advertisements); instead they should contain a nucleus of new, scientific and/or technical information.

The papers marked with * at the page number in the Table of Contents did not conform, as manuscripts, to the "Instructions for Authors" in some respect:

1. because of a misunderstanding many authors of non-invited papers thought it was allowed to submit papers longer than 6 pages. A considerable number of these papers have been shortened by me by using the space available more efficiently, e.g. by reducing the size of figures and tables and by rearranging these (in particular I tried to limit the size of a manuscript to an *even* number of pages). However, often this was not possible. I apologize to the authors who did confine the length of their paper to 6 pages and now might have the feeling that they have been treated unfairly;
2. page length was not 24.5 cm (14.5 cm for title page) an/or page width was not 17 cm;
3. figures and tables were not of correct size and/or not fixed at the appropriate places in the manuscript;
4. coloured pictures were not allowed (although this was not explicitly stated).

With a few exceptions, I did not correct the English of those manuscripts which, even on the basis of my limited command of the English, exhibited a considerable amount of grammatical and orthographical errors.

All modifications have been performed as carefully as possible.

E.J. Mittemeijer