

INTRODUCTION TO SURFACE ENGINEERING

This easy-to-read work provides a comprehensive, state-of-the-art review of the three principal groupings of surface engineering (SE) technologies designed to achieve the surface protection of engineering products: diffusion technologies, deposition technologies and other, less acknowledged techniques. Specific applications are cited throughout the book but are further augmented by focused chapters on how SE is used to combat the surface degradation of devices and products deployed in automotive, gas turbine engine (GTE), metal machining and bio-medical implant sectors. A detailed chapter on surface degradation mechanisms is also included. The book is generously illustrated with summary tables, line drawings, halftone photos and microscopy images.

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Introduction to Surface Engineering

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‘A journey of a thousand miles begins with one small step.’

—attributed to Lau Tzu (604–531 BC)

Per ardua, ad alta . . . always persevere.

For SYC and EK

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Preface

The idea of writing an introductory book on surface engineering has been in my mind since the mid-1980s following my inculcation into this field by the late Professor Thomas Bell of the University of Birmingham, UK. However, this was not at all my first experience of the subject, having completed a PhD thesis on the wear mechanisms of CVD-coated cemented carbide cutting tools in 1980 under the guidance of Dr Edward Moor Trent, who wrote a seminal text called *Metal Cutting* and whose guidance in stimulating constructive and systematic methods of thinking and observation has remained with me to this day. I owe my initial exposure to the world of materials science and metallurgy to Paul King, formerly Chief Inspector and Chief Metallurgist of the Duport Steel Group, who recruited me as a ‘green’ trainee and who first introduced me to the ‘mysteries’ of steel and its heat treatment and the wonderful world of microstructures before my formal university education began. After graduation from the University of Birmingham in 1977 and 1980, I began my postdoctoral research experiences at Sandvik Hard Materials UK (with Alistair Grearson and others) and at the University of Birmingham (with Tom Bell and colleagues) and finally at the University of Cambridge (with Professor Bill Clyne and others). These experiences allowed me the privilege of working first-hand with advanced surface technologies that included plasma nitriding, plasma boriding, CVD, PVD and plasma spraying in vacuo. It also brought me in to contact with many exceptional thinkers, both in industrial and academic environments. Subsequently, I was fortunate to be able to pass on my experiences to students at the undergraduate and postgraduate levels – initially whilst I was a lecturer and senior lecturer at the University of Auckland, New Zealand, and latterly from 1996 at the University of Leeds, UK. This was by no means a one-way experience; I learnt a lot from these people, and I am grateful to those who stimulated creative discourses, particularly within the privileged role that I had as a research student supervisor/adviser. I am also happy to mention those who spent periods of sabbatical leave that enabled additional research in my university research laboratory. In this regard, I want to specifically acknowledge the following for their contributions: Yong Sun, Karl Dahm, Bertram Mallia, Iain Anderson, Nimesh Shah, Giles Aldrich-Smith, Kostos Panagopoulos, Jun Komotori, Daisuke

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If as a result of this book, individuals are stimulated to enquire more deeply into the subject or are inspired to carry out and/or organise new research or construct new ways of teaching surface engineering, I will consider the effort of putting this book together a worthwhile endeavour.

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