SURFACE ENGINEERING
FOR CORROSION AND WEAR RESISTANCE

Edited by

J.R. Davis
Davis & Associates
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Preface

Corrosion, wear, or the combined effects of these destructive failure modes cost industrial economies hundreds of billions of dollars each year. One of the more effective means of mitigating damage due to corrosion and wear is to treat, or “engineer,” the surface so that it can perform functions that are distinct from those functions required from the bulk of the material. For example, a gear must be tough and fatigue resistant yet have a surface that resists wear. For applications requiring only a moderate degree of impact strength, fatigue resistance, and wear resistance, a higher carbon through-hardening steel may be sufficient. For more severe conditions, however, a surface hardened steel may have to be used. What are the options? Should the gear be flame or induction hardened, carburized or nitrided, or would high-energy processes such as laser- or electron-beam hardening be more appropriate? As a second example, consider the use of steels for various outdoor structural applications. Steel is popular because it is inexpensive, strong, and easily fabricated. Unfortunately steel is highly susceptible to severe corrosion in many environments and must be coated to achieve a satisfactory service life. Once again there are a variety of options. Should the component be painted, hot dip galvanized or aluminized, electroplated, thermally sprayed, or clad with a more corrosion resistant material? For large steel components, such as bridge members, size, weight, and handling problems may limit the type of surface treatment considered. Finally, take into consideration parts that require wear-resistant, thin-film coatings. Can more conventional chromium or hard nickel electroplating be used, or will harder coatings deposited by vapor deposition techniques or ion implantation be required? Will processing time or temperature be a factor in coating selection?

From the above discussion, it is apparent that engineers are faced with a bewildering number of choices when selecting the appropriate surface engineering treatment for a specific corrosion and/or wear application. But where does one start? Where can a design engineer find practical guidelines to aid in the selection process? The answers to these questions
lie within *Surface Engineering for Corrosion and Wear Resistance*. In addition to devoting an entire chapter to process comparisons (see Chapter 7), this book contains dozens of useful tables and figures that compare surface treatment thickness and hardness ranges; abrasion and corrosion resistance; processing time, temperature, and pressure; costs; distortion tendencies; and other surface treatment characteristics that must be considered when choosing the right coating for the job.

The starting point for this publication was an excellent overview published by the Institute of Materials (IOM) entitled “Surface Engineering to Combat Wear and Corrosion: A Design Guide,” which was written by Keith Stevens (A.T. Poeton Ltd.). Assisting IOM in the project was AEA Technology plc. and their National Centre of Tribology located in Risley, United Kingdom. The IOM booklet presents a concise methodology for understanding corrosion and wear problems and the many factors that must be considered before selecting a surface treatment. Material from the IOM design guide can be found primarily in Chapter 7, “Process Comparisons,” and Chapter 8, “Practical Design Guidelines for Surface Engineering.” Special thanks are due to Stephen Harmer, the editor of the IOM “Design Guide” series, who also reviewed several key chapters, and Bill Jackson, Head of Publishing for IOM, who worked out the copublishing agreement with Scott Henry, Assistant Director of Reference Publications for ASM International.


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