Title	**Self_organization_During_Friction**
Author	German S.Fox-Rabinovich,George E.Totten
Source	Taylor & Francis Group
Pub Date	2007
Brief Introduction	

Preface

Friction is an extremely complex phenomenon that can be studied in depth using ideas of modern physics that deal with the problems of complexity. One of the most generic ideas considering the complexity of natural processes is the concept of self-organization.

This book is devoted to the self-organization phenomenon, physicochemical aspects of friction, and the methods of friction control using advanced materials and surface-engineering techniques.

The major topics of this book are: nonequilibrium thermodynamics, self-organization phenomena during friction and wear, tribological compatibility, and methods of friction control for heavily loaded tribosystems such as cutting and stamping tools. The key concept focuses on the issue of tribological compatibility, which is the capacity of two surfaces adapting to each other during friction, providing wear stability without surface damage for the longest period of time. This is both a generic physical and an engineering approach to the development of new wear-resistant materials and coatings.

In this context, friction control implies the existence of a stable tribosystem, which resists any instability leading to intensive wear and surface damage. From the point of view of a self-organization process, both the natural (friction-based) and synthetic processes of materials' design and engineering are outlined in this book. Therefore, we could control the synthetic processes of material engineering to encourage the evolution of natural processes occurring during friction that lead to minimal wear rate. This is the typical friction control with a positive feedback loop that results in significant tool life improvement.

The main objectives of this interdisciplinary project are: (1) to combine the fundamentals of thermodynamics and methods of material characterization including nanotribological methods, studies of tribological behavior of a wide range of materials, and (2) to present to the scientific and engineering community a new approach to the development of an emerging generation of surface-engineered self-adaptive materials. Much attention in this book is paid to the adaptive tooling tribosystems and surface-engineered materials. The main feature of these adaptive materials is that they exhibit protective properties in their structure and function that are similar to natural or biological systems. New generations of surface-engineered nanostructured materials could be considered as specific "nanomachines" that transform the tribosystems working under extreme external impact with excessive wear to those with milder friction conditions of critically decreased wear rate. It will be shown that the abnormal capacity of these materials to resist external impact is associated with their nanoscale structure, synergistical alloying, and nonequilibrium state of the surface-engineered layers. It confirms that enormous energy stored in the nanoworld has to be released in order to fully perform its protective functions.

The metallurgical design of the novel tooling materials is based on surface-engineering techniques, particularly the plasma vapor deposition (PVD) technique, as well as powder metallurgy methods. Other methods that improve the tool–workpiece tribological compatibility (such as solid lubricant application) as well as the adaptive design of cutting tools are considered as well.

This book is primarily directed at researchers in the field of material science and manufacturing engineering, demonstrating new approaches to the development of the next generation of self-adaptive materials with critically enhanced workability and wear resistance. This book could also be used as a research monograph for academic libraries.

German S. Fox-Rabinovich
George E. Totten