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This special issue of the Journal of Materials Research contains articles that were accepted in response to an invitation for manuscripts.

THE SCIENCE AND TECHNOLOGY OF VAPOR PHASE PROCESSING AND MODIFICATION OF SURFACES

Introduction

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There are many ways to modify the surface properties of materials, depending on the need. With advanced surface modification, the surface energy of a material or device can be tuned to desired properties. These properties can be permanent or temporary. Surface modification tools such as plasma-enhanced physical vapor deposition and chemical vapor deposition processes, high energy ion implantation, high-power impulse magnetron sputtering, plasma electrolysis, and discharge deposition have resulted in significant improvements in material properties for biomedical devices, MEMS, bearings, and cutting tools. These advances have been enabled by the development of new thin film deposition approaches, epitaxial schemes, multi-structured buffer layers, computational simulations, and new analytical probes to investigate the details of interface chemistry and structure. While many advances have been empirical, scientific understanding of the behavior of such surface modified materials is needed to accelerate further progress.

This *Journal of Materials Research* Focus Issue offers papers that report advances in the synthesis, processing, and performance of materials enhanced by vapor phase processes. Special attention has been given to papers focused on surface reaction dynamics and film growth, the science and technology of surfaces and interfaces, and the mechanism of property enhancement, involving the utilization of advanced instrumentation such as chemical vapor deposition, physical vapor deposition, ion implantation, reactive ion etching, etc.

We are very grateful to both the authors and reviewers of the many high-quality manuscripts submitted to this *JMR* Focus Issue on Advances in the Science and Technology of Vapor Phase Processing and Modification of Surfaces.

On the cover

The cover of this Focus Issue shows the 3D profile of the SEM images of single crystalline diamond surface with mosaic surface patterns, fabricated by inductively coupled plasma reactive ion etching (ICP-RIE). Owing to its outstanding mechanical, electrical, chemical, and thermal properties, diamond is far superior to many other materials and is a very attractive functional material for special tools, optical devices, biosensors, quantum computation, and microelectromechanical systems. ICP-RIE is an effective tool for the precision structuring of diamond surface for the next-generation wide band gap semiconductor electronic devices.