NITRIDES AND OXYNITRIDE MATERIALS

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

Introduction

Guest Editors:

Joan Redwing
The Pennsylvania State University, USA

Zoltan Lences
Institute of Inorganic Chemistry, Slovak Academy of Sciences, Slovakia

Rong-Jun Xie
National Institute for Materials Science, Tsukuba, Japan

Tania Paskova
North Carolina State University, USA

Nitride-based compounds have established themselves as singular materials with wide ranging applications in solid state lighting, displays, power electronics and photovoltaics, thanks to their remarkable properties and capabilities beyond those of other electronic materials. Despite the fact that many nitride-based devices are already on the market, numerous challenges remain to be resolved in order to fully explore and implement their potential. In addition, it has been recently shown that the unique features of these materials, such as polarity, can lead to new device modes or improved device performance. The convergence of nitride materials and nanomaterials could lead to additional functionalities when combined with organics and polymers. Fundamental understanding of underlying mechanisms of surface, interface, doping and defect-related properties is key to achieving full control of nitride-based device performance and will lead to exciting opportunities for further improvements, inventions and commercialization.

This Focus Issue of the *Journal of Materials Research* (*JMR*) captures papers that explore recent scientific and technological achievements from research groups with diverse backgrounds in nitride and oxynitride materials and nanomaterials. Three review papers address major representative topics of nitride based MQW structures, the nitride surface functionalization specifics upon solution treatments and oxidation behavior of hafnium-tantalum nitrides. Other papers track critically important challenges in nitride growth technology, such as stress related phenomena in nitride heterostructures and polarity identification of wurtzite structures aiming to mitigate the polarization induced effects by employing nonpolar and semipolar device alignment. Functionalized nitride surfaces are paid special attention as one of the least explored areas in the field but one of the most promising systems for a number of chemical and biochemical sensor applications. Recent advances in metal oxynitrides, thio-oxynitride phosphate glass electrolytes, and silicon nitride ceramics are also represented. The issue contains reports of new information extracted from in-situ studies of nitride growth and surface treatments and oxidation, providing new opportunities for process control and ensuring material quality.

Overall, the Focus Issue brings together recent new findings in nitride structure growth, oxynitride deposition, surface processing, characterization and analysis.

ON THE COVER:

Ultramicroporous silicon nitride-based materials can be applied for CO_2 capture what is regarded as one of the biggest challenges of the 21st century. The enhanced CO_2 capture capacity of porous nitride-based materials is because of the presence of nitrogen-containing basic groups, together with hierarchical mesostructures, which include relatively high BET surface, stable framework and the presence of a large number of micropores as well as small mesopores. Schitco, Seifollahi Bazarjani, Riedel, and Gurlo demonstrate that the pore size plays a crucial role in elevating the CO_2 adsorption capacity of ultramicroporous silicon nitride-based material surpassing the effect of BET specific surface area.

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