Foreword

Symposium on "Dynamic Behavior of Materials: VI" in Honor of Professor Marc André Meyers TMS Annual Meeting, San Diego, 2014

The field of dynamic behavior of materials comprises diverse phenomena such as deformation, fracture, fragmentation, shear localization, damage dissipation, and chemical reactions occurring under extreme conditions, as well as processing *via* shock compaction, explosive welding and forming, and reaction synthesis of novel materials. It has evolved considerably in the past 20 years and is now at a stage where its significance to all classes and forms of materials including metals, ceramics, polymers, and composites is becoming relevant in applications addressing various societal challenges.

The sixth "Dynamic Behavior of Materials" symposium sponsored by the TMS/ASM Mechanical Behavior of Materials Committee was held in honor of Professor Marc André Meyers during the TMS Annual Meeting in San Diego, February 17 to 20, 2014. Marc Meyers was the co-founder of these symposia, because he saw the necessity for a forum for the presentation and discussion of the materials aspects of dynamic deformation, a need that became apparent as the EXPLOMET conference series created by him and Prof. L. E. Murr in 1980, continued until 2000. The symposia have covered a broad range of phenomena associated with extreme environment and relevant to technological applications in military and civilian sectors. The 2014 symposium recognized the many contributions of Professor Meyers whose work has elucidated the broad scope and the state of the art in our understanding of the effects of high strain rate and shock-compression response on process/structure/property behavior, from constitutive modeling and mechanisms of plastic deformation and phase transformations, to the synthesis of biomimetic materials and the development of improved armor materials.

The principal recognition from his research comes from the following seminal contributions:

- His mechanism for homogeneous dislocation generation in shock compression which is an important component of modern understanding on the subject and has been confirmed by observation and simulations.
- His pioneering use of tensile pulses to establish the thermodynamic and kinetic parameters of martensitic transformations.
- His proposal that dynamic recrystallization plays a pivotal role in shear localization and the mechanism he developed.
- The experimental and analytical treatment of the self organization of shear bands, jointly with V. F. Nesterenko.
- The proposal, with V. Lubarda of a new dislocation mechanism for void growth in ductile failure.
- The quantification and successful prediction of a threshold pressure for twinning in shock compression, first observed by L. E. Murr.
- He spearheaded the use of pulsed lasers for the study of shock compression, reducing the time duration of pulses from microseconds (in gas-gun and explosive experiments) to nanoseconds.
- Analytical demonstration that flash X rays could be used to extract material shear strength at strain rates of the order of 10^7 s^{-1}.
- Development of experiments and theory of shock-induced reaction in powders.

It is well recognized today, as evidenced by the contributions in this current volume that the "materials science" aspects of dynamic behavior are of utmost importance. The macro mechanical and physical processes that govern

material behavior in extreme dynamic loading events manifest themselves at the microstructural level, by a dazzling complexity of defect configurations and their effects. The symposium provided a platform for discussions on how these processes/mechanisms can be quantitatively treated on the basis of accumulated knowledge. The presentations focused on applications of multiple technologies of this field including crashworthiness, machining, and important military effects of armor and projectile designs, ballistic penetrations, and explosive dynamics. Applications in the medical field, from traumatic brain injury and drug delivery, to the influence of dynamic behavior during high-rate processing, including compaction, synthesis, welding, forming, *etc*., were also discussed. The speakers represented a diverse community, those whom Professor Meyers considers as mentors to those who regard him as their mentor, and students and faculty at universities to distinguished scientists at national labs. The peer-reviewed papers included in this issue contain contributions by leading researchers from the US, Europe, Latin America, and Asia. The topics cover a broad range of phenomena including spalling, impact welding, armor, explosives, adiabatic shear bands, ultrafine-grained metals, constitutive behavior, phase transformations, and biological materials, presented through the framework of experiments and theory based on computations, diagnostics, and microstructure characterization.

Marc A. Meyers is a Distinguished Professor of Materials Science at the University of California, San Diego. His research has spanned the field of mechanical behavior of materials, with the focus on dynamic behavior, and nanocrystalline and biological materials. In the area of dynamic behavior, his unifying theme has been the effects of high-rate events in materials. He initiated this work in 1972 and has dedicated 43 uninterrupted years, unifying the area by emphasizing the physical and chemical phenomena. His honors include—Fellow of TMS, APS, and ASM, as well as awards in the US (ASM Albert White Teacher, TMS Cohen, TMS Educator, ASM Sauveur, Acta Materials and Society, SMD/TMS Distinguished Engineer/Scientist, and Service Awards), Europe (Humboldt, DGM Heyn, and DYMAT Rinehart Awards), and China (Lee Hsung Award). He is a member of the Brazilian Academy of Sciences and of the Luxembourg Academy (Institut Grand Ducal).

Professor Meyers has been a beacon of research excellence, an internationally recognized researcher, who has tirelessly spanned the gaps between materials science, metallurgy, physics, biology, and engineering. He created the first laboratory for the study of shock waves in Latin America (Military Institute of Engineering, 1974) after his doctoral studies on shock strengthening of superalloys. At New Mexico Tech, he co-founded the Center for Explosives Technology Research, a highly successful endeavor that welcomed leading researchers from around the entire globe. His contributions are broad and deep; he has published over 300 papers in the field of dynamic deformation and authored the classic book ''Dynamic Behavior of Materials (1994, ~2000 citations in Google Scholar).'' His ISI citations exceed 10,000 and his H Index is 50. He has made seminal contributions to the theory of defect generation in shock compression, the use of shock-induced tensile pulses to determine the kinetics of martensitic transformations, and the understanding of the dynamic recrystallization in adiabatic shear bands, and shock-induced chemical reactions. More recently, he has, with LLNL colleagues, spearheaded the use of laser shock compression to elucidate the response of materials under extreme conditions of high pressure and strain rate. The sixth ''Dynamic Behavior of Materials'' symposium held in honor of Professor Meyers is truly befitting his contributions to the field and his many accomplishments.

Symposium Organizers:
Naresh Thadhani
Georgia Institute of Technology,
Atlanta
naresh.thadhani@mse.gatech.edu

George T. (Rusty) Gray III
Los Alamos National Laboratory,
Los Alamos