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losses as well as enhancement in defined perceptua[redacted]gnitive and/or motor abilities. Investigations can span the gamut from multi-unit recordings through evoked [redacted]tials and neuro-imaging technologies to humoral and psychological correlates of both central and periph[redacted]ervous system function. Non-medically oriented research designed to elucidate the fundamental physiology [redacted]lying cognition and possible non-invasive methods of monitoring cognitive states and processes during n[redacted] activity is appropriate. Perceptual and/or psycho physiological implications of mind-machine interf[redacted]anging from optimizing auditory, visual and/or somatosensory display and control systems based [redacted]ysiological or psychological states through modeling of individual cognitive dynamics and decision makin[redacted]ppropriate to this research area.

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RESEARCH AREA 9
MATERIALS SCIENCE

8.0. The objective of research supported by the Materials Science Division of the Army Research Office is to discover the fundamental relationships that link chemical composition, microstructure, and processing history with the resultant material properties and behavior. The work, although basic in nature, is focussed on developing new materials, material processes, and properties that promise to significantly improve the performance, increase the reliability, or reduce the cost of future Army systems. With the need for lighter weight and higher performance systems in the future, program emphasis has increasingly shifted away from metals research to a more balanced program with interests that cross a broad spectrum of materials, including polymers, ceramics and semiconductor materials. Fundamental research that lays the foundation for the design and manufacture of multicomponent systems such as composites, hierarchical materials and "smart materials" is of particular interest.

Potential offerors are encouraged to contact the appropriate Technical Point of Contact (TPOC) for preliminary discussions on their ideas. The TPOC may invite the offeror to submit a preproposal.

9.1. Materials Design. The objective of the materials design program is to tailor material properties for application-driven property requirements. The research should investigate property interrelationships in materials growth, processing or characterization with the approach eventually leading to stronger coupling of experimental research with theory or modeling (including phenomenological modeling). The goal is to predict and control material behavior during processing and operation, to predict property changes over time (based on science rather than statistics), to optimize performance and reliability, and to reduce cost and time to development. It would also be advantageous to develop strategies to define constraints imposed by the experiment and theory and to establish and populate open databases for processing-microstructure-properties-performance etc. These could be continually updated to enable design, simulation, modeling and theory to evolve and ultimately for property tradeoff in support of performance optimization to occur. In addition, this should also facilitate communication among researchers and engineers at the materials, subsystem, and system level. One area of emphasis will be surface and interface engineering in support of materials integration. There is particular interest in identifying new ways of combining similar and dissimilar materials which provide multifunctional capabilities, recognizing that functionality is often derived from properties very close to the interface. Processing models that build a solid theoretical underpinning will be a key to control/optimization of surface and interface properties. Surface and interface research in areas such as organic/semiconductor, bio/semiconductor, or bio/organic/semiconductor interfaces; dielectrics/semiconductor interfaces; transparent conductive thin films; dissimilar material and nano electrical contacts; and bonded or alternative substrates can be envisioned. Another area of emphasis will be development of in-situ and ex-situ analytical methods for analysis over the appropriate dimensions, that is, methods with appropriate spatial resolution or appropriate sensitivity. The goal is to understand and control material and growth parameters that affect a desired or undesired property within a particular property range. Other areas of interest are investigations of high temperature materials and their relevant degradation modes; development of adaptive materials capable of response to internal or external stimuli; study of self-repair or self-healing effects; growth and characterization of embedded nano-sized constituents designed for material and performance health monitoring; and investigations of novel methods leading to large-scale, large-quantity processing of nanomaterials. It is intended that in addition to

promoting convergence, combination and integration of similar and dissimilar materials the program also promotes convergence of and cross-disciplinary concepts for materials design.

Technical Point of Contact: Dr. William V. Lampert; email: William.V.Lampert@us.army.mil, (919) 549-4325.

9.2 Mechanical Behavior of Materials: The Mechanical Behavior of Materials program seeks to establish the fundamental relationships between the structure of materials and their mechanical properties as influenced by composition, processing, environment, and loading conditions. The program emphasizes research with the potential to dramatically enhance the mechanical properties of known materials systems and research that seeks to develop innovative new materials with unprecedented combinations and formulations of mechanical, and other complementary, properties. Critical to these efforts is the need for new materials science theory that will enable robust predictive computational tools for the analysis and design of materials subjected to a wide range of specific loading conditions, particularly theory which departs from standard computer algorithms and is not dependent upon tremendous computational facilities. The primary research thrust areas of this program include: a) high strain-rate phenomena (e.g., experimental and computational analysis of the physical mechanisms which govern deformation in advanced materials, lightweight damage tolerant materials); b) property-focused processing (e.g., materials science theory to predict the range of properties attainable with advanced processing methods, novel approaches for enhancing specific toughness); and c) tailored functionality (e.g., innovative materials containing unique and specifically designed chemical and biological functionalities and activities while maintaining, or preferably enhancing, requisite mechanical properties).

Technical Point of Contact: Dr. David Stepp, e-mail: David.M.Stepp@us.army.mil, (919) 549-4329.

9.3. Synthesis and Processing of Materials. The program on Synthesis and Processing of materials focuses on the use of innovative approaches for processing high performance structural materials reliably and at lower costs. Emphasis is placed on the design and fabrication of new materials with specific microstructure, constitution, and properties. Research interests include experimental and theoretical modeling studies to understand the influence of fundamental parameters on phase formation, micro structural evolution, and the resulting properties, in order to predict and control materials structures at all scales ranging from atomic dimensions to macroscopic levels. Trends in this subfield include non-equilibrium materials processing (e.g., rapid solidification); powder synthesis and consolidation; novel processing of ceramics, polymers, metals and composites; welding and joining including composite materials; elastomers; fibers and fabrics; and utilization of micro structural, compositional, or other unique signatures which may provide non-destructive in situ feedback process control to enhance product reproducibility and quality. Supercritical fluid, shock-induced chemical processing and other innovative approaches for processing materials are also of interest.

Technical Point of Contact: Dr. William Mullins, e-mail: William.Mullins@us.army.mil, (919) 549-4286.

9.4. Physical Behavior of Materials. The program of Physical Behavior of Materials seeks research directed at providing an improved understanding of the fundamental mechanisms and key materials and processing variables that determine the electronic, magnetic and optical (EMO) properties of materials and affect the reliability of EMO devices. Emphasis is on research that will facilitate the nanostructuring of materials to realize the materials-by-design concept where new and unique materials are constructed on the atomic scale with application-specific properties. This includes research on understanding the underlying thermodynamic and kinetic principles that control the evolution of microstructures; understanding the mechanisms whereby the microstructure affects the physical properties of materials; and developing insight and methodologies for the beneficial utilization and manipulation of defects and microstructure to improve material performance. Major trends in this subfield include: (i) electronic materials - materials for microelectronics and packaging; fabrication and processing of semi-conductors, interconnects and device structures, and the characterization and control of trace impurities, defects and interfaces in semiconductors, (ii) magnetic materials - bulk and thin-film processing of magnetic materials for electronic and high frequency communications; and fundamental studies on magnetic coercivity and spin dynamics, and (iii) optical materials - materials and processing methods for detectors, lasers, nonlinear optical materials, refractive and diffractive optics, and optical windows and coatings. Research to improve the long-term stability of EMO materials, develop multifunctional or smart EMO materials, and develop low observable materials is also being sought.

Other important areas of interest include new approaches for materials processing, new composite formulations, and surface treatments that minimize environmental impacts; and novel composite concepts, including multifunctional and hierarchical materials. Finally, there is general interest in identifying basic research in the area of manufacturing science, which will address fundamental issues related to the reliability and cost (including environmental) associated with the production and long-term operation of Army systems. The foregoing areas of research are not intended to reflect all of the activities of the Materials Science Division. We are always interested in new ideas and cross-disciplinary concepts in materials science that may have future applications for the Army.

Technical Point of Contact: Dr. John Prater, e-mail: John.T.Prater@us.army.mil, (919) 549-4259.

ARO SPECIAL PROGRAM AREAS 10

10.1. SHORT TERM INNOVATIVE RESEARCH (STIR) PROGRAM. The objectives of the STIR program are to fund innovative ideas in basic research. Proposed research may be for the continuation or the natural outgrowth of experimental or theoretical explorations.

10.1.1 Eligibility. Research proposals are sought from educational institutions, nonprofit organizations, and commercial organizations.

Potential offerors of a STIR proposal are encouraged to contact the appropriate Technical Point of Contact (TPOC) identified in PART I, Research Areas 1-9 of this BAA for preliminary discussions on their ideas. The TPOC may invite the offeror to submit a preproposal.

10.1.2. Research Sought. Proposals in the amount of $50,000 or less are sought for research in the areas identified in PART I, Research Areas 1-9.

10.1.3. Proposal Preparation.

10.1.3.1. Organizations or institutions should submit proposals that are no more than twenty (20) pages in length, inclusive of the budget, transmittal letter, and attachments. Any proposal in excess of 20 pages will not be considered. No brochures or explanatory material should be submitted with the proposal. A one-page budget must accompany the proposal.

10.1.3.2. Proposed research efforts must be "stand alone" and not predicated on the use of any facilities other than those under the direct control of the offeror. Research must be completed within nine (9) months of award of the agreement. **Extensions of the nine-month performance period will not be granted.**

10.1.3.3. Proposals shall be submitted with a Proposal Cover Page (Form 51). Limited rights data should be identified as an attachment to the proposal. Otherwise, we will assume that the proposal does not contain limited rights data.

10.1.3.4. No capital equipment may be purchased. Travel costs must not exceed $500. Report preparation costs must not exceed $100. The assessment of indirect costs or fee is unallowable.

10.1.3.5. The principal investigator(s) should disclose and explain the relevancy of the proposal to the research interests identified in PART I, Research Areas 1-9.

10.1.3.6. A brief, final technical report must be submitted to the ARO within thirty (30) days of completion of the grant or contract. Please note that your award document will reference Form 18, "Reporting Instructions," as found at http://www.aro.army.mil/index.htm .You shall use these reporting instructions for format instructions only; the due date for receipt of a final technical report is thirty (30) days from completion of the award.

10.1.3.7. Submit electronic proposals to the address found in Part IV, Section 2, General Preparation and Submission Information.