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Multi-scale Statistical Design of High Energy Density Materials JOSEPH C. FOSTER, D. SCOTT STEWART, University of Illinois, KEITH THOMAS, Los Alamos National Laboratory — High energy density materials [HEDM] find wide ranging application in commercial and defense applications. The engineering design of these materials is represented by a hierarchy of specifications on materials and processes. The specifications range in scale from molecular by specifying polymorphic crystal structure to macroscopic specifying geometry and global density. These specifications are used to control the configuration of the production HEDM component in the system design. A formalism analogous to that used in statistical mechanics is presented to aid in the interpretation of physical variability of the design based on specification. A multi-dimensional design space with restrictions imposed engineering specifications is proposed to construct an ensemble of specific designs represented by the variability allowed in the specifications. Based on a physical interpretation of the specifications and how they might apply to the physical function of the component; the formalism is intended to provide a well posed basis for the interpretation of design/ function relationships and fluctuations in behavior.

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