

Additive Materials and Design for Dynamic Loading Applications

Enhancing Performance in Safety, Security, and Defense

We develop materials and structures for applications in highly dynamic loading scenarios through additive design and manufacturing, enabling novel solutions such as enhanced crashworthiness, blast mitigation, or ballistic protection. This comprises the development of materials with tailored properties as well as the optimization of structural design. Our capabilities cover design, simulation, material development, and testing.

Optimization of Kinetic Energy Absorbers

We develop methods to enhance cellular structures' performance under dynamic loads for various applications, including helmets, body armor, and blast mitigation.

- Optimization of cellular structures
- Developing AI-supported optimization approaches
- Auxetic lattice and minimal surface structures
- Simulation of blast and impact loads
- Experimental validation for crash, impact, and blast

Metallic Materials for High-Speed Dynamics

We provide steels and heavy metals engineered for dynamic loads, addressing challenges like micro-cracks and creating functionally graded microstructures to enhance properties.

- High-performance steels: armor, high-strength, tough
- Processing of heavy metals: tungsten, tantalum, copper
- Metal-matrix composites: W-Fe, W-Ta
- Microstructural gradients and Adapting mechanical properties

Multidisciplinary Design Optimization

To reduce weight and integrate functionality, we develop generative design workflows for multiphysics loads. Our topology optimization focuses on lightweight structures for crash and impact applications.

- Multiphysics optimization
- AI-supported generative design
- Structural design for crash, blast and impact

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[exhibit overview](#)