

# **Integrated Materials and Products Design: Design of Blast Resistance Panels and Materials**

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## **Abstract**

*Integrated Materials and Products Design (IMPD)* is a new paradigm of systems-based design to enhance product performance by concurrently tailoring materials and product. IMPD involves the development of new materials with specific properties to meet design requirements. In traditional approach, *material selection design* (Ashy, 2005), the design alternatives from a material database are screened, ranked and then chosen from material indices. In IMPD, however, materials as well as product layout and dimensions, and geometry are designed concurrently. IMPD incorporates a number of material models for tailoring the material structure and/or processing paths to meet the requirements of specific design problems rather than being limited by the need to select a material from a database.

One of the unresolved challenges in IMPD is high degree of uncertainty in the material models. Moreover, the uncertainty in the material models is propagated and expanded through a hierarchical material model chain (Olson, 1997) to product level simulation models, such as structure, thermal and dynamic simulation model. In this paper, the author highlights this important issue and introduce a design method, called *Inductive Design Exploration Method (IDEM)* (Choi, 2008), to manage the uncertainty propagation by effective engineering decision-making in IMPD. For the validation purpose, blast resistance panels (Xue and Hutchinson, 2003) and those materials are designed to achieve enhanced performance of life protection against massive bomb attacks.

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