

# Advanced Aerogel Packaging Solution for Cold-Chain Biologistics

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**Abstract:** Long distance transportation of biological and pharmaceutical materials is currently limited due to the fact that most containers have a limited time that temperatures inside the containers can be kept steady and at the required low temperature. In some cases expensive and heavy data loggers are used that need to be returned to the vendor upon delivery of the biological and pharmaceutical products. Aerogels are currently known as the best insulating material and have demonstrated superior thermal insulating capability ( $R\text{-value/inch}=10.3$ ) compared to materials routinely used in the shipping and storage industry such as extruded polystyrene ( $R\text{-value/inch}=4.1$ ) and polyurethane foam ( $R\text{-value/inch}=6.9$ ). Its lightweight and biologically-friendly nature makes this material an excellent choice for biologicistic packaging solutions. Preliminary experiment data and modeling performed by the team has demonstrated the feasibility of using the aerogel as a component material in wide variety of low temperature (77K-273K) applications. Here, we propose the design, construction, and testing of a light-weight aerogel-based containment package for vials that can be utilized for the safe transportation of temperature sensitive biological materials and pharmaceuticals. Experiments and simulations will be conducted with the prototype to facilitate comparison of the thermal and mechanical performance to existing packaging solutions.