Cold chain management

Fast and accurate digital simulation of temperature-sensitive product packaging

Benefits
- Quickly optimize package designs and subsequent revisions
- Predict and evaluate the impact of ambient temperature excursions on product integrity
- Virtually evaluate distribution routing alternatives
- Design for compliance with industry standards: FDA, ISTA, TR39
- Reduce cost and effort for thermal testing and prototype development
- Create confidence in product integrity at all points in supply chain

Features
Advanced and proven simulation solutions provide:
- System-level modeling of product, packaging and environment
- Support for wide range of PCMs, gel packs and shipper designs
- Simulate temperature response over any distribution network
- Optimize payload packouts for various seasonal cycles
- Simulate drop/shock and vibration

Summary
NX™ software accelerates the design, development and validation of complex cold chain distribution systems by reducing the time and costs involved in iterative physical testing of pack-out configurations. Accurate correlation of simulation results with test data can reduce extensive design and validation cycles. In many cases, results are obtained in a fraction of time required for a physical test.

Simulation enables Siemens NX customers to work faster and look at multiple design configurations. This added flexibility helps in creating fast, efficient and effective cold chain packaging solutions.

Effective cold chain packaging and distribution systems are critical for the safe and efficient transport of many temperature-sensitive products. Product temperatures during shipping depend on complex packout configurations and often need to be validated for specific shipping routes. Physical testing and validation, following GMP guidelines, takes considerable time, effort and cost, directly impacting transportation efficiency and cost effectiveness.

Product losses due to improper packout configurations can be significant
Temperature stability during shipment is necessary to ensure product safety, quality and efficacy.

Extensive physical testing is required to achieve:
- Packaging certification per FDA specification
- Cost effectiveness of proposed packaging on a specific routing

The solution is applicable to both active and passive packaging systems. NX not only enables companies to optimize pack design for different routes and seasonal cycles, but can also help validate packaging integrity subjected to drop/shock and vibration effects. This reduces design cycles and physical testing for cold chain packaging systems.

"Today we are designing and testing temperature-sensitive transport shippers virtually with NX. This has made us faster, more flexible and more effective at helping our pharmaceutical and biotech customers protect their valuable products throughout the transportation cold chain."
Larry Gordon
President, Cold Chain Technologies

NX

SIEMENS

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Features *continued*
So you can:
- Develop successful active and passive shipper designs
- Optimize packout designs and routing combinations virtually
- Minimize the cost of protecting your products

The use of advanced thermal simulation technology can greatly benefit design, development and testing of cold chain distribution packaging. Simulation facilitates quick and efficient development of digital thermal models using real environmental conditions. Thermal modeling contributes significantly towards the reduction of time in design cycles and product release.

Siemens PLM Software's predictive technology can be utilized to design any passive or active shipping configuration, as well as simulate its transportation over any route. Simulation provides accurate temperature predictions quickly and efficiently for any packaging system, allowing optimization of payload configurations. Simulation results have been extensively validated against physical test data for a wide range of packaging options. Accurate prediction of any excursions in product temperatures during

a transportation cycle can be easily visualized, resulting in reduction of testing time and costs.

Complex physics inherent in cold chain shipper design can be modeled precisely. Transient phenomena, such as phase change, which have a direct impact on product temperatures, are predicted accurately. Powerful 3D flow technology is automatically coupled with thermal simulation to model buoyancy-driven flow in shipper air gaps. Environmental heating effects, such as solar heating, can be modeled accurately at any global location. Humidity distribution and condensation on surfaces can be calculated based on local thermal and flow conditions.

Siemens also provides structural analysis tools used to model static and dynamic response of shippers and packaging systems. Structural simulation software can be used to accurately simulate ISTA standards such as drop/impact and random vibration tests.

*Images courtesy of Cold Chain Technologies.*
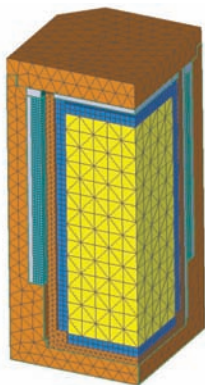
Typical packouts can be easily modeled using powerful meshing techniques. Components such as PCMs, gel packs, product packages, etc. can be represented quickly and accurately.
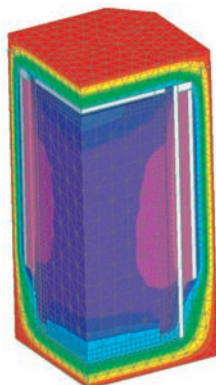
Phase change characteristics of PCMs can be modeled efficiently and accurately.

Phase change characteristics of PCMs can be modeled efficiently. Transient response of PCMs and the effect of conduction-only and conduction-plus-convection can be accurately determined.
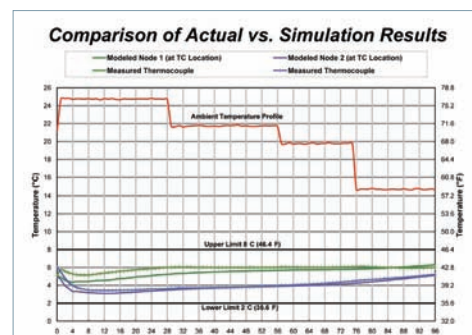
Thermal simulation of shipper assembly for a 96-hour summer profile
- *Product temperature response predicted correctly to within 1°C of test data*
- *Accurate results obtained in 7 hours compared to physical test lasting 96 hours*

Siemens works with a specialist partner experienced in the modeling of complex thermal environments and correlating simulation with real-life performance. Together we deliver software and training, the skills required to help you minimize time-consuming and expensive physical testing, increasing your business flexibility and ensuring that you have protected the integrity of high-value products throughout the transportation cold chain.

Our solution is proven and provides extremely close agreement between simulation results and experimental data.

Cold Chain Technologies is a global provider of thermal packaging solutions to the pharmaceutical, biotech and health care industries. With engineering services, products and distribution throughout North America and Europe, CCT's team leads the industry in delivering innovative solutions for the control of temperature-sensitive shipments.

KoolDesigns™, Cold Chain Technologies' service offering based on Siemens NX Advanced Thermal technology, accomplishes the complex task of predicting thermal performance of its transit package designs by accurately modeling conduction, convection, phase change, and radiation.

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