

Wireless Traceability of Prepreg Product Temperature

Industrial Challenge

Manufacturers, processors, and users of time and temperature sensitive (TATS) materials are audited by regulatory bodies, such as the Federal Aviation Administration (FAA), and OEMs, such as Boeing, Airbus & Lockheed. Manufacturers and processors reference industry procedural and quality documents to establish methods of monitoring temperature and out-time of TATS materials, which require control from fabrication through final manufacturing to ensure acceptable material performance. Common technology used for traceability of environmental temperature conditions are circular chart recorders and electronic data logging devices. The drawback of this type of equipment is that it requires manual labor to collect, download, and file data, hence leaving room for human error. Records also need to be readily accessible when an auditor is on site for inspections.



Introduction

This solution brief provides information and guidance concerning temperature and out-time monitoring of prepreg materials during storage and transportation. Solutions are applicable to prepreg, carbon fibers, fiberglass, Kevlar, potting materials, sealants, and a variety of other time and temperature sensitive (TATS) materials manufactured for use in the aerospace, automotive, sporting goods, and wind energy industries. The solutions offered within this document apply to prepreg manufacturers, composite processors, and Original Equipment Manufacturers (OEMs).

Out-time is described as amount of time material can be at room temperature and still be useable. Out-time requirements can range from minutes to 30 days or more. Whenever material is removed

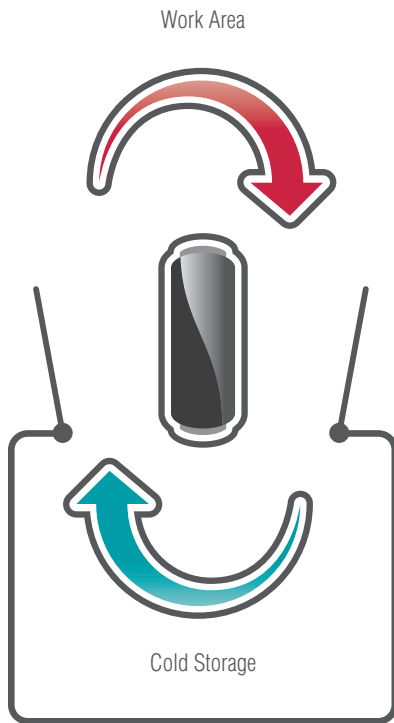
from cold storage the out-time clock starts ticking, and if the material is not completely used it is returned to the freezer. An out-time record must be kept for each roll, reflecting the total time the roll is exposed to environments above the recommended storage temperature. Current industry practice is to calculate out-time manually using a paper log or chart. Each time material is removed from storage, an employee is responsible for writing down the time it was out, and calculating the remaining shelf life of that material. Some manufacturers may have as many as 500 rolls of TATS material throughout a facility, so manual calculation of out-time can become a labor intensive, complex process. In addition, once a roll of material is shipped or depleted in process, that out-time record must remain on file at the facility for audit purposes.

The Product

Composites are engineered materials made by combining two or more elements, for example, fiber-reinforced polymers are made from fibers (carbon, glass, Kevlar etc.) and a polymer/plastic, such as epoxy. Resins or epoxies are required to bond the fibers together at a microscopic level, in order to achieve unique properties. When combined, it produces a very strong, but extremely light material. The use of resins requires that rolls of prepreg fabric must be stored at low temperatures (0°C) because the resin transforms at warmer temperatures. The fibers are used in textiles, woven goods (i.e. plain weave fabrics) or in unidirectional products, such as tape.

Industries using prepreg materials call for strict adherence to engineering requirements, which entails stringent tracking, recording and processing of prepreg material to ensure parts are defect-free. To meet demand, remain competitive, save time and costs, prepreg manufacturers must streamline roll storage, processing and shipping within required temperature ranges.

OEMs, such as Boeing and Airbus, pass on their process standards to prepreg suppliers in order to ensure materials are



delivered according to quality specifications for their industry. An OEM also requires the prepreg supplier to show traceability of product within set parameters. Auditable documentation must detail the total out-time of the material, from fabrication until it is received by the OEM.

Manual Tracking

Typically, at the manufacturer's facility prepreg rolls are kept at 0°C (-32°F) in temperature controlled storage rooms. When they receive an order it may be for all or only a portion of the roll. The manufacturer must remove the product from storage, cut the roll as needed, and return the remaining product to storage. While the roll is out, it is exposed to room temperature, causing the resin to progress into a chemical transformation which reduces shelf life. If the roll is continually exposed to room temperature the manufacturer must eventually scrap the remaining product or spend considerable time retesting it to establish if there

is additional shelf life. Careful tracking of cumulative time out of 0°C (-32°F) storage becomes a critical issue that must be monitored and recorded carefully.

Automating Out-Time

Without an automated temperature monitoring system in place, the process involves manual tracking. As prepreg materials come off the production line, they are assigned a tracking number. As it enters storage, time is noted on a paper chart and subsequently recorded each time the roll is moved in and out of storage, adhering to customers' out-time traceability requirements. This process can be extremely labor and time intensive. Other issues related to a manual process include human error, lost paperwork, and lack of traceability. Prepreg manufacturers and users can benefit from an automated, traceable, error-free way to monitor, track, and record cumulative out-time.

DeltaTrak Solution: FlashLink® RF System

DeltaTRAK® offers an automated, wireless, real-time monitoring, recording and alarm system which gives management the product visibility and traceability it needs to meet internal and external quality control, and regulatory guidelines. The FlashLink RF Wireless System™ collects information around the clock, with real-time data visible on a PC monitor at any time, while also storing it electronically. Alarms can be set up to send alerts to personnel, indicating occurrences of temperature excursions or amount of out-time (shelf life) remaining for inventory management purposes.

The FlashLinkRF System will automatically monitor prepreg rolls from fabrication to shipment, and can further track them in transit to the customer. RF data loggers send signals to a wireless receiver, which

is a gateway between the wireless network and corporate IT systems. Wireless repeaters and Bluetooth Range Extenders boost signals from Loggers to Receiver, in order to overcome physical obstacles in line of site. The software is a unique, interactive, multi-level, facilities mapping program that gathers, logs, tracks, and reports data.

As a prepreg roll comes off the fabrication line, a barcode label is printed, attached to the roll and correlated to a DeltaTRAK FlashLink RF Logger which is also placed on the roll. Each roll would have a wireless logger attached to it before being placed into the freezer, and, at this point, the system begins clocking shelf life. As each roll leaves the freezer, the logger sends the time information to the network; and, upon returning to the freezer, time back in is transmitted. The software then calculates out-time; a percent of life remaining for each roll, based on time spent out of cold storage. Data is reported in graph, text, or Excel format. The software can also be programmed to emit an audible alarm on the computer, and/or send an email alert or text message when product is close to out-time limits. It also allows personnel to access data remotely.

Conclusion

Any manufacturer with TATS materials susceptible to shortened shelf life would benefit from a wireless, automated, time and temperature system with round-the-clock monitoring capability. Being able to track product shelf life is not only valuable, but required in many industries that must adhere to specific design requirements. Manual monitoring on paper charts is time consuming, costly, prone to human error, and lacks real-time traceability. These challenges are easily addressed with an automated, wireless, monitoring system.

© Copyright 2010 DeltaTrak, Inc.

DeltaTrak® is a leading innovator of cold chain management, environment monitoring and food safety solutions for the food, pharmaceutical, life sciences and chemical industries. Contact DeltaTrak by phone at 1-800-962-6776 or by email at marketing@deltatrak.com. Additional information can be found at www.deltatrak.com.

