LHS® FILL & FLOW – FLAME RETARDANT THERMAL MANAGEMENT MATERIALS

latent heat solutions
a CAVU group company

LHS® thermal management materials provide energy absorption, heat storage, and heat dissipation characteristics for passive thermal control. Our Fill & Flow (F&F) materials are designed to provide passive thermal management to an optimally designed pack. LHS thermal management provides for homogeneous and lower pack/cell temperatures leading to longer cell life and lower overall energy and replacement costs. Our F&F-FR materials are flame retardant variants of our standard F&F products with improved flame suppression properties.

LHS F&F-FR is specifically designed to fill enclosed and small cavity systems by completely flowing around and contacting all fully enclosed cell and pack surfaces.

LHS® F&F-FR – TYPICAL PROPERTIES

Supplier: Latent Heat Solutions LLC
Product: Li-ion cell thermal management.
End Use: Passive thermal management in optimally designed enclosed energy, battery and electronics systems.

LHS Product	F&F-91FR	F&F-92FR
Melt Temperature (°C):	49-51	53-57
Latent Heat (J/g):	165-175	165-175
Density (g/cm3)	1.15	1.15
Viscosity above PTT (cps):	25-100	25-100
Dielectric Constant	3.5	3.5
Dielectric Strength (MV/m)	37 MV/m	37 MV/m
Insulation Resistance Observed, 25°C (solid) / 70°C (liquid) @ 1000V (MΩ):	>1000 / >1000	>2000 / >1000
Insulation Resistance Observed, 70°C at 50% RH/ 96 hrs., 1000V (MΩ):	>1000	>1000
Surface Tension (mN/m)	27-31	27-31
Thermal Conductivity-Below PTT (W/mk)	0.35	0.35
Thermal Conductivity-at/above PTT (W/mk)	0.3	0.3
Specific Heat Capacity-Below PTT(J/g °C)	1.75	1.75
Specific Heat Capacity-at/above PTT(J/g °C)	2.2	2.2
RoHS 3	Compliant	Compliant
Direct Flame/Burning Cup	Pass	Pass

***Other phase change temperatures upon request.**

Latent Heat Solutions LLC
831 Pine Ridge Road
Golden Colorado 80403

sales@quanzen.com
lhsmaterials.com
P: +91 91684 02373

Storage

Store in cool, dry place away from direct sunlight. Storage is preferably between 0-30° and best if used within 12 months.

Flammability

LHS F&F materials are not conventional plastics and therefore cannot be rated per the standard UL94 test method. These materials are considered nonflammable materials with a NFPA 704 and HMIS nonflammable rating of 1. Flame retardant variants are analyzed using a modified burning cup/direct flame method.

Prototype Processing

F&F materials are supplied as solids and must be heated to their full liquid state before use. Small amounts of F&F materials can be heated in a glass or metal beaker. This is best carried out either in an oven or on a hot plate at 10-20°C above its transition temperature, but the temperature should not exceed 85°C.

It is recommended, but not critical, that the enclosure or pack to be filled be preheated to 30-45°C. This allows the material to completely fill and flow into all cavities and crevices before cooling and solidifying. If pack or enclosure is to cool, the F&F material can quickly solidify, blocking areas and preventing homogeneous and complete encasement. It is also possible to lean or slant the pack to aid in complete void filling.

Enclosure or Pack Filling

The most suitable method is to completely melt the material at 10-20°C above its transition temperature in one of the preferred material containers mentioned. If material is supplied in drums or pails, it can be melted and used directly from these containers but should not be used for long term storage. For bagged material please see storage and processing guidelines below.

It is recommended, but not critical, that the enclosure or pack to be filled be preheated to 30-45°C. This allows the material to completely fill and flow into all cavities and crevices before cooling and solidifying. If pack or enclosure is to cool, the F&F material can quickly solidify, blocking areas and preventing homogenous and complete encasement.

Large Scale Storage and Processing

The most suitable material for warehouse or commercial storage is either bags, pails, or drums as supplied. Bulk storage tanks can be used and preferred materials are stainless steel, pure aluminum, rubber, polyethylene, polypropylene or polyethylene-lined containers and storage tanks made from glass-fiber-reinforced polyester (GRP). Materials should be check for compatibility per below. The tank should be ventilated by means of a silica gel dryer. Conventional steel tanks are of limited suitability because after prolonged storage the product may become discolored due to traces of iron.

Latent Heat Solutions LLC
831 Pine Ridge Road
Golden Colorado 80403

sales@quanzen.com
lhsmaterials.com
P:+91 91684 02373

If stored in a bag, the material should be stored below its transition temperature to prevent agglomeration or leakage. However, when stored in a closed and sealed container, the long-term storage temperature should not exceed 70°C, and it is advisable, especially with bagged material, to thoroughly mix the contents of the storage container in the molten state before or during dispensing. This mixing can be accomplished by mixing blade, pump circulation, or bubbling dry nitrogen through the material. Material from bags should be mixed using a mixing blade to ensure proper agitation prior to dispensing.

Band heaters and electrical immersion heaters are not suitable for heating due to the high thermal stress and localized hot spots which lead to overheating and degradation.

Dispensing and Filling Equipment

Production dispensing procedures and equipment are generally designed to a company's specific needs and production operations. Dispensing equipment can be as simple as a temperature-controlled heating blanket around a drum with a hand-controlled dispensing valve or as expansive as jacketed tanks with metered pumps and computer controlled dispensing valves.

Examples of suitable commercial production equipment are general hot melt dispensing machines supplied by companies such as Graco, Nordson, Valco Melton, or various industry distributors.

Compatibility

It is recommended that compatibility testing be undertaken with all pack components to insure long term stability. Thermocycling, as opposed to static soak, is recommended due to varying conductivities and heating rates which can affect the solubility and thermal stresses on materials and parts.

Generally, most engineering polymers such nylons, polyetherimides, PBT, etc. will be acceptable materials. Polypropylene, polycarbonates and polycarbonate alloys, should be avoided or specifically evaluated due the broad range of grades, alloys, and copolymers. Glass filled materials need to be evaluated due to various fiber aspects, interactions with fiber sizing/coatings, and to glass fiber wicking (fibers act as wicks to material interior).

IMPORTANT NOTE

This data has been compiled from testing that Latent Heat Solutions LLC (LHS) believes reliable and supplied for informational purposes only. LHS encourages purchasers to validate this data and the product's fitness for use in the purchaser's process by performing their own tests.

Latent Heat Solutions LLC
831 Pine Ridge Road
Golden Colorado 80403

sales@quanzen.com
lhsmaterials.com
P:+91 91684 02373