

# HYTAC<sup>®</sup> - C

## Castable Syntactic Tooling

### Technical Bulletin



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*Innovative Tooling Materials for Thermoforming*

## Overview

*HYTAC-C* is a one-part castable product in the *HYTAC* family of syntactics. This product is available as an uncured, single component mixture that may be poured or cast into a wide variety of shapes and sizes. Provided in one-gallon containers, the premixed syntactic flows smoothly into any tool or cavity. After curing, the product exhibits the same properties found in CMT's *HYTAC-W*:

- **Low Thermal Conductivity and Specific Heat**
- **Dimensionally Stable**
- **Excellent Temperature Resistance to 350°F**
- **Lightweight**
- **Easily Machined**

## Applications

*HYTAC-C* may be used in a wide variety of applications on sheet-fed, rotary, or in-line machines. It may also be used with most commonly thermoformed materials, as well as some of the more exotic materials available today.

## Usage

*HYTAC-C* is formulated as a pre-blended, single component mix to minimize handling. No weighing or mixing of resin, catalyst, or filler is required. Simply allow the product to warm to room temperature, pour or inject into a tool or cavity treated with mold release, then cure in an oven at the recommended temperature. The completed plug may then be easily removed from the cavity for post cure or use.

## Typical Properties

The table below outlines some typical *HYTAC-C* properties following cure:

Property	Value(SI Units)	Value(Eng Units)
Density ( $\rho$ )	0.705 g/cc	44.0 PCF
Thermal Conductivity ( $k$ )	0.28 W/m-°K	0.16 BTU/hr-ft-°F
Specific Heat ( $C_p$ )	0.92 J/g-°K	0.22 BTU/lb-°F
Coefficient of Thermal Expansion ( $CTE$ )	$31 \times 10^{-6}$ cm/cm/°K	$17 \times 10^{-6}$ in/in/°F
Compressive Strength	55 MPa	8,000 Psi
Compressive Modulus	2,070 MPa	300 Ksi
Service Temperature	180 °C	350 °F

## Service

CMT is committed to providing cost effective, high performance, engineered material solutions to the tooling industry. We would be pleased to speak with you about your application. Call or FAX us today.

## **HYTAC-C**

### **CASTING & CURING RECOMMENDATIONS**

#### **Overview**

*HYTAC-C* is a specialty pre-blended mixture of epoxy resin, curing agents and hollow glass microspheres. This one part mixture must be kept cold to prevent the reaction of its components. The mix is shipped in sealed, insulated containers to minimize elevated temperature exposure. The shelf life of the material is highly dependent on storage conditions. It is recommended that the material be stored in a refrigerated unit at a maximum temperature of 40°F.

The casting operation is a simple four step process:

1. Allow the required amount of material to warm to room temperature, (usually overnight)
2. Prepare the mold or cavity by cleaning the surface and applying mold release
3. Inject/pour the *HYTAC-C* into the cavity or mold using care to minimize air entrapment
4. Cure the mix at the recommended temperature, (normally dependent on the mold material)
5. Demold the part and postcure.

#### **Storage & Shelf Life**

The storage conditions under which the *HYTAC-C* is kept determine the product shelf life. Care should be taken to store the material immediately upon receipt at a maximum temperature of 40°F. Shelf life for material kept below 40°F is six months. The material must not be stored in a refrigeration unit with any food products.

#### **Molds & Surface Preparation**

A wide variety of materials may be used as molds into which the desired shape is cast. However the temperature resistance of the mold material should be taken into account when determining the cure conditions, (i.e. Cure temperature should not exceed the maximum working temperature of the mold). Various plastics (polyethylene or polypropylene especially), most metals, wood, plaster, fiberglass, rubber, RTV, and silicones may be used as molds.

Mold surfaces should be cleaned with a solvent or alcohol wash then coated with a mold release prior to filling. Several commercial mold releases work well with the epoxy based syntactic. CMT has successfully used Frekote 44 or 770-NC or AC 4368, from Dexter Phone No. (800) 767-5541, or Freeman 054420 Silicone Spray from Freeman Mfg. Phone No. (800) 631-4230 for a wide range of castings. Follow the recommended manufacturers' procedures when applying the mold release.

#### **Casting/Injection**

The material must be allowed to warm to room temperature prior to casting to assist in flow. It is best to allow the material to warm up slowly at room temperature for 10-20 hours rather than in a heated oven to prevent the material from reacting. Gallon containers should be allowed to warm with the cover in place. If less than a full container is required, the desired amount of material should be removed from the container and allowed to warm to room temperature separately.

When working with the uncured syntactic, normal precautions should be used to prevent unnecessary contact with the skin or eyes. Although the material presents no unusual safety or health hazards, wearing safety glasses and protective gloves is a common sense approach.

Once the syntactic has reached room temperature it may be poured directly into a large cavity, or warmed to 120°-140° F to further reduce the viscosity for small cavity pours. No mixing is required at this stage. The material may also be de-aired under vacuum, (where available), at this time to remove any entrapped air. Care should be taken when transferring the mix into the mold so as not to introduce additional air into the mix. The mix should be poured down the side of the mold to minimize further entrapped air. Fill the mold cavity to the desired level and allow the mix to settle.

**Cure & Post Cure**

When the mix has settled in the cavity, transfer the mold to a pre-heated oven. The initial oven temperature and the duration of cure will be dependent upon the melt temperature of the mold material. Duration is also dependent on the thickness of the parts being cast and the size and shape of the mold. Experimentation is often needed to determine the proper cure cycle for a given part. Large parts should be cured at a maximum of 200°F to reduce the chance of exotherm. Small parts may be cured more quickly. Typical curing times are given below:

<u>Oven Temperature</u>	<u>Minimum Cure Time</u>
160°F	18-24 hours
200°F	8-10 hours
250° F	4-8 hours

Allowing the parts to cure for periods longer than listed as typical is recommended where feasible. Slow cool down rates are also recommended to minimize thermal stress cracking, especially on large parts. Ramping heat-up temperatures on large parts is also recommended.

Once the part has cured, it may be removed from the mold and post cured to 275 °F for a minimum of six hours. Again, slow heat up and cool down rates are recommended to minimize thermal stress.