

# HydroCOC Hydrophilic masterbatch

HydroCOC masterbatch is an additive in pellet form to be mixed with Topas 8007s-04 for injection molding. Topas 8007s-04 mixed with HydroCOC masterbatch is in this datasheet called HydroCOC. The unique feature of HydroCOC is that molded devices are hydrophilic (low contact angle) directly from the molding machine. No coating, treatment or plasma processes are needed.

HydroCOC can be used for a number of applications but is developed for microfluidics and single use medical devices.

## HydroCOC features

- Devices are hydrophilic directly from the molding machine
- HydroCOC masterbatch is 10% hydrophilic additive in Topas 8007s-04
- HydroCOC masterbatch is delivered in pellet form ready for use
- Can be used with standard injection molding machines
- Long functional life (10+ years) thus easily supporting a 2 year shelf life of a device
- HydroCOC devices are tolerant to storage without temperature control
- Biocompatible

## Recommended mix ratio

We recommend 1 part masterbatch pellets plus 9 parts Topas 8007s-04 pellets (ratio by weight). This corresponds to 1% hydrophilic additive in molded devices. However, devices can be hydrophilic at half of the recommended concentration or even less, see the molding examples later in this datasheet.

## Machine compatibility

In order to get hydrophilic and transparent molded devices, it is necessary that the molding machine properly mixes HydroCOC masterbatch with Topas 8007s-04. Haze or hazy streaks in the molded devices or devices not being hydrophilic can indicate poor mixing.

## Material compatibility

HydroCOC is compatible with most materials, but there are substances it is not compatible with. These include; Chlorine, Hypochlorides, Peroxides, Ozone etc. These are all very reactive substances, and these may inactivate the HydroCOC surface, so it is no longer hydrophilic. Oil and silicone in the mold tool or air, will deposit an invisible thin hydrophobic coating on devices thus rendering them much less hydrophilic.

## Optical properties

HydroCOC in Topas 8007s-04 at the recommended concentration is clear and transparent. A very faint yellow tone can occur if there is moisture in either the Topas 8007s-04 or the HydroCOC masterbatch. If this occurs, it is recommended to dry the materials before molding.



## Hydrophilic characteristics

### Contact angle

Depending on the process settings and the device design, contact angle (CA) for HydroCOC is 10°-20°. This is enough to ensure, fast and stable capillary flow, prevention of air bubbles etc. Molded devices are hydrophilic immediately after molding. If molded devices have a higher contact angle than 20°, then the molding settings must be adjusted, see Processing guidelines for details on this.

### Hydrophilic comparison

- |                           |        |                           |
|---------------------------|--------|---------------------------|
| • PMMA/Acrylic            | CA=73° | $\cos(73^\circ) = 0.2924$ |
| • Standard Topas 8007s-04 | CA=85° | $\cos(85^\circ) = 0.0872$ |
| • HydroCOC (1%)           | CA=15° | $\cos(15^\circ) = 0.9659$ |

The cosine to the contact angle is a measure of how fast capillary flow will be.

Reference for cosine to the contact angle

- |          |  |
|----------|--|
| 0.25-0.3 | The "capillary friction" of a channel. The threshold for capillary flow.         |
| 0.70     | Medium speed and highly stable capillary flow.                                   |
| 0.90     | Fast and stable capillary flow.  |
| 0.98     | Very fast flow. For some designs this may be too hydrophilic, and thus unstable. |

## Material properties

The physical and molding properties of HydroCOC are very close to the properties of Topas 8007s-04.

## Functional life of HydroCOC

### In dry air storage

Devices made hydrophilic with HydroCOC will maintain the hydrophilic property for a very long time when stored in dry air. In moist air the functional life is shorter but how much shorter depends on molding settings, additive concentration and storage conditions.

### In contact with water

When contacting water, the hydrophilic property will decay over time. How fast it decays depend on temperature and the physical conditions (flow, bubbles, physical contact etc.).

We do not recommend HydroCOC for use in devices intended for multiple uses, or for devices requiring the hydrophilic property over extended periods of time in contact with water.



## Processing guidelines

HydroCOC can be processed using standard injection molding machines. HydroCOC is not suitable for extrusion.

### Drying

HydroCOC MB should be dried prior to use (60-80°C in dry air for 24 hours). HydroCOC MB will absorb atmospheric moisture over time, and this will reduce hydrophilicity and cause yellow discoloration of the molded devices. After opening a bag of HydroCOC MB, it should be stored dry to prevent absorption of moisture. If the material has absorbed moisture, we recommend discarding the material and continuing with a new bag of HydroCOC MB.

### Temperature settings

Zone 1 / Rear	180°C - 230°C	
Zone 2 / Center	220°C - 260°C	
Zone 3 / Front	240°C - 300°C	
Zone 4 / Nozzle	250°C - 300°C	<b>Minimum injection temperature 250°C.</b>
Mold	20°C - 40°C	

These settings are not specifications and should be seen as a starting point for optimization.

While HydroCOC can be molded at standard Topas 8007s-04 settings, the hydrophilic property is activated only at certain molding conditions.

#### For maximum hydrophilicity we recommend:

- **High injection temperature (hydrophilicity is activated by the high temperature)**
- **Slow or very slow injection speed (hydrophilicity takes time to evolve during filling)**
- **Low mold temperature (as low as you possibly can while still getting fully formed parts)**

If your molded devices are not sufficiently hydrophilic then adjust these three settings.

#### Example

Our test device becomes fully hydrophilic at these settings:

- 270°C injection temperature
- 10 mm/s injection speed corresponding to 1 second cavity filling time
- 30°C mold temperature

The optimal settings vary depending on factors such as molding machines, device geometry, and tool design. Therefore, the provided example is meant for inspiration only.

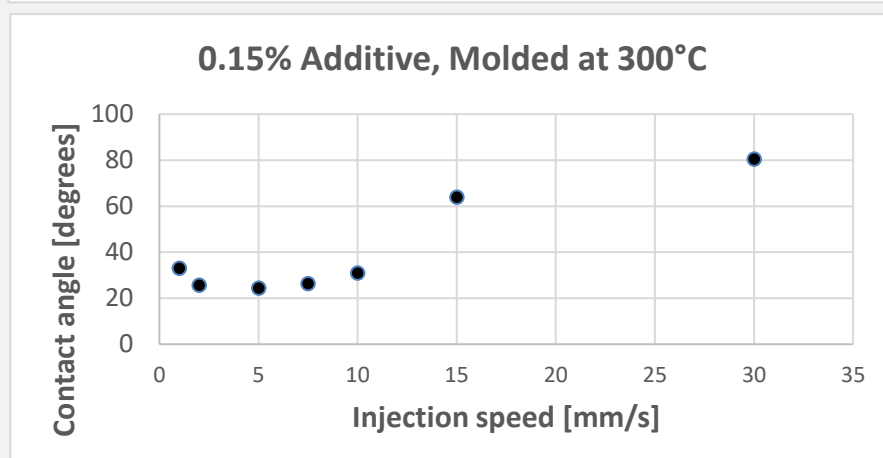
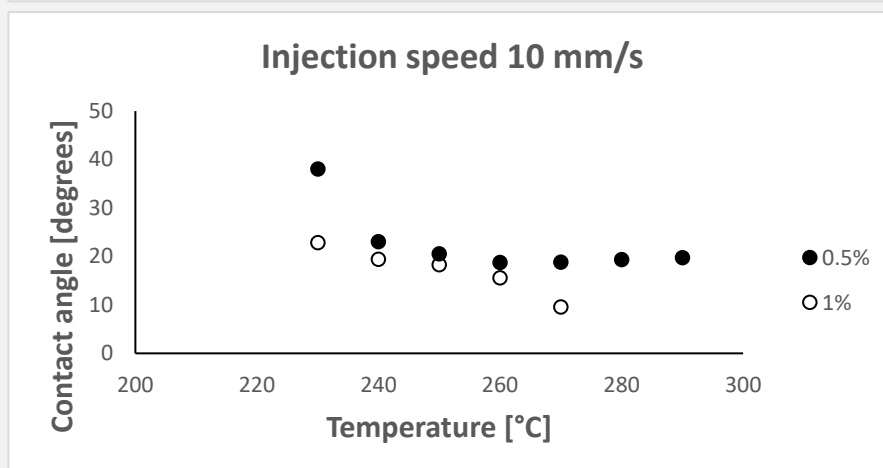
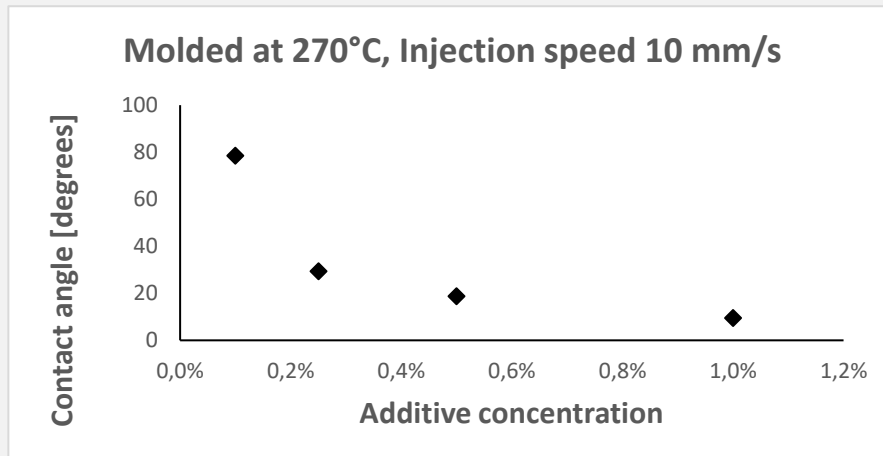
### Release agents

Do not use mold release agents or add anything to the HydroCOC material. Release agents are often oily substances which will leave a very thin and invisible hydrophobic residue on the molded devices. The hydrophobic residue covers the HydroCOC hydrophilic material, and the device thus becomes hydrophobic. **Do not use mold release agents!**



## Molding examples of our test device

Molding of our test device for different injection temperature, injection speed and additive concentration. As these examples clearly show; temperature and especially injection speed is very important to get molded devices with a low contact angle. These characteristics will vary with device and mold design and should not be considered a specification. However, in all cases contact angle will decrease as temperature is increased and speed is decreased.



## Storage, disposal and safety

### Storage

Store HydroCOC devices and pellets dry and in sealed plastic bags. To avoid condensation of water on the HydroCOC pellets, the material should be given time to reach room temperature before opening the plastic bags.

### Disposal

HydroCOC and HydroCOC MB may be included with other waste containing similar plastic materials to be discarded for destruction or reclaim in accordance with local state and federal regulations. It is the responsibility of the customer to ensure the disposal of HydroCOC is made in observance of all applicable environmental regulations.

### Environmental, Health and Safety

HydroCOC in both pellet and molded part form, is biocompatible and completely safe. No safety precautions are needed but getting HydroCOC dust into eyes/lungs should be avoided. Like any other plastic material, HydroCOC will decompose slowly in nature and thus shouldn't be released in nature or other uncontrolled environments.

### Warranty

The information in this datasheet is based on our experience and is, we believe to be reliable, but may not be complete. We make no guarantee or warranty, expressed or implied, regarding the information, use, handling, storage, or possession of this product, or the application of any process described herein or the results desired, since the conditions of use and handling of the product is beyond our control.

