

# X100 Hydrophilic coating

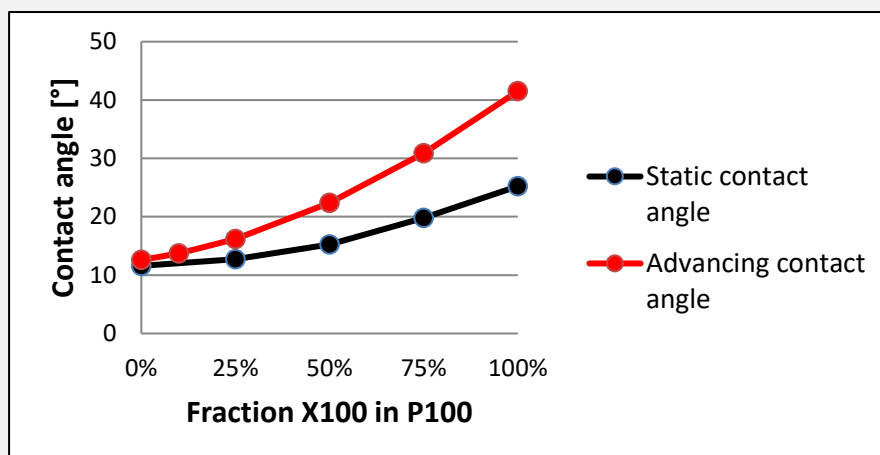
For variable contact angle between 10° and 45°

X100 is a patent pending coating with unique hydrophilic properties, which can be applied to most surfaces and materials. X100 is intended to be used with our standard hydrophilic coating P100, to give any desired contact angle between 10° and 45°. The main application for this is for capillary filled medical devices and microfluidics, where it is used to control the flow speed.



## Controlled contact angle

It is often good to have a specific contact angle in a given device, to get the combination of fast flow, control and reliability. The P100 coating gives a contact angle of 10°±5°. If this gives too fast or uncontrollable flow, then X100 is mixed with the P100 solution before coating the device. Depending on how much X100 is added to P100, the advancing contact angle can be increased to ~45°.



## X100/P100 Coating features

- Controlled advancing contact angle between 10° and 45°
- X100 and P100 are fully compatible
- Long functional life (10+ years) thus easily supporting a 2 year shelf life of the coated medical device
- Fast, simple and flexible coating process (5 seconds coating and 10 seconds drying)
- Coating tolerant to storage without temperature and humidity control
- Excellent adhesion to most materials
- High optical clarity due to a very thin coating
- Biocompatible (works with antibody assays, PCR and blood based systems)
- Safe solvent chemistry
- Only recommended for single use due to the strong interaction with liquid water.
- FDA approved ingredients

## Capillary flow

Capillary flow requires that the internal surface of the device is hydrophilic. A surface is rarely hydrophilic in its native state, but it can be made hydrophilic by coating it with for example P100. The capillary force and thus the flow speed depend on how hydrophilic the surface is, and on the internal geometry of the device. The contact angle is often used to describe how hydrophilic the surface is. The advancing contact angle is the parameter most relevant for capillary flow, since the capillary force scales with the cosine of the advancing contact angle.

For this reason most development engineers prefer a very low contact angle to maximize flow speed in their device. Coatings such as P100 will give such a very hydrophilic surface. However, having a very hydrophilic surface is not ideal in some cases. In combination with complex internal geometry a very hydrophilic surface may give uncontrollable flow that are likely to trap air bubbles. On the other hand a too high contact angle will give slow and sometimes unreliable flow.

For these reasons it is best to be able to control and adjust the contact angle of the device. This can be done by coating the device with a mixture of X100 and P100. The contact angle is controlled by the ratio of X100 and P100 in the coating solution.

## Processing guidelines

### Mixing X100 and P100

P100 and X100 are formulated with the same solvent and are fully miscible. Add the selected volumes of P100 and X100 in a beaker or bottle and mix gently. P100 and X100 readily mix so there are no special requirements.

### Material compatibility

For any material we have tested X100/P100 has given uniform coatings, excellent adhesion and left the surface hydrophilic. Tested materials; Polycarbonate, polystyrene, Acrylic/PMMA, COC/COP, PCL, glass, paper, Aluminium, Steel, PCBs.

Please note that the contact angle depends on the properties of the surface to be coated.

Therefore it is necessary to test the resulting contact angle of a given material and device, and adjust accordingly.

### Surface preparation

The surface to be coated with X100/P100 should be clean and free of dust, oil, water and volatiles. Other than this the surface does not need any preparation.



## Processing guidelines (continued)

### Coating methods

X100/P100 can be applied to most substrates by spray, dip, spin, brush, roller or ink-jet coating. The available equipment and the device to be coated will determine the best coating method. Regardless of the coating equipment, it is essential that the entire surface is wetted with the coating solution.

The internal surfaces of a finished device can also be coated by filling channels etc. with the coating solution by capillary force, and then letting it dry from the device openings or blowing the device dry by compressed air. A word of caution on this coating method; during drying the solution will concentrate at locations of high capillarity (small geometry), and the coating at these locations may thus be unacceptably thick.

### Drying

At room temperature the solvent will evaporate very quickly, often the surface will be dry in 5-10 seconds after coating. No additional drying is needed. It is recommended to ensure proper ventilation to remove the evaporating solvent.

### Coating thickness

The optimum X100/P100 coating thickness is 10 nanometer. The minimum coating thickness is 5 nanometer, below this the coating is less hydrophilic and may have shorter functional life. The coating can have any thickness greater than 10 nanometers, but the coating does not become more hydrophilic and with great thickness it also becomes hazy. An X100 coating at 10 nanometer thickness should be invisible to the unaided eye. If the coating is visible (haze, fringes, visible structure etc.) then it is thicker than it need be. When done correctly it is not possible to see if a surface is coated or not.

### Removal

If needed an X100/P100 coating can be removed by washing the coated surface in IPA. Ultrasound or mild abrasion may be needed to remove X100/P100 completely.

### Initial R&D work

For initial R&D work it is recommended to coat a device by an airbrush with a fine nozzle. If no airbrush is available a quick dip coat works as well. Regardless of the coating method, it is essential that the entire surface is wetted with the coating solution.

After coating simply leave the device in air to dry.





## Storage, disposal and safety

### Storage

#### Liquid X100 solution

Store X100 upright and in tightly closed containers in a cool, dry environment away from direct sunlight at a temperature of 4-27°C (40-80°F). Shelf life is 24 months from date of manufacture.

#### Dry X100/P100 coating

Unlike many hydrophilic treatments, a device with an X100/P100 coating can be stored at normal room temperature and without humidity control, provided these conditions do not cause condensation of water on the X100 coated surface.

The device with the X100/P100 coating should be stored so it is not exposed to;

- Temperatures above 60°C (a 5 minute exposure to 120°C is acceptable for welding)
- Liquids or condensing atmosphere
- UV radiation
- Abrasion

An X100/P100 coating is very tolerant toward low and high humidity, temperature variations and vibration.

### Disposal

X100 may be included with other waste containing similar organic solvents 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 X100 and residues made in observance of all federal, state, and local environmental regulations.

### Environmental, Health and Safety

#### Liquid X100 solution

X100 solution is mainly Isopropanol (IPA) use the same precautions you would when using IPA. Handle with care. Wear chemical goggles, chemical gloves and suitable protective clothing when handling X100. Do not get into eyes, or onto skin or clothing. Use with adequate ventilation to avoid breathing vapors or mist. In case of contact with skin, wash affected area with soap and water. In case of contact with eyes, rinse immediately with water and flush for 15 minutes lifting eyelids frequently. Get emergency medical assistance.

#### Dry X100/P100 coating

When dried the X100/P100 coating is biocompatible and completely safe. No precautions are needed, but we don't recommend getting X100/P100 dust into the eyes or consuming it.

### 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.

