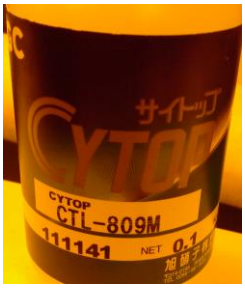
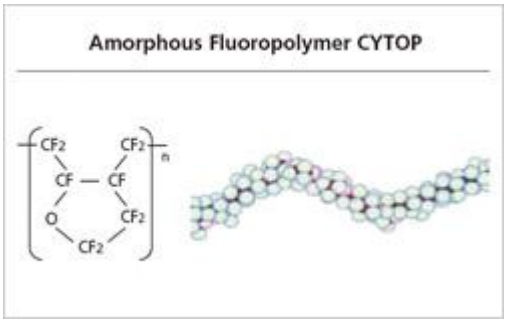
CYTOP™
Mr. Artemio Perez



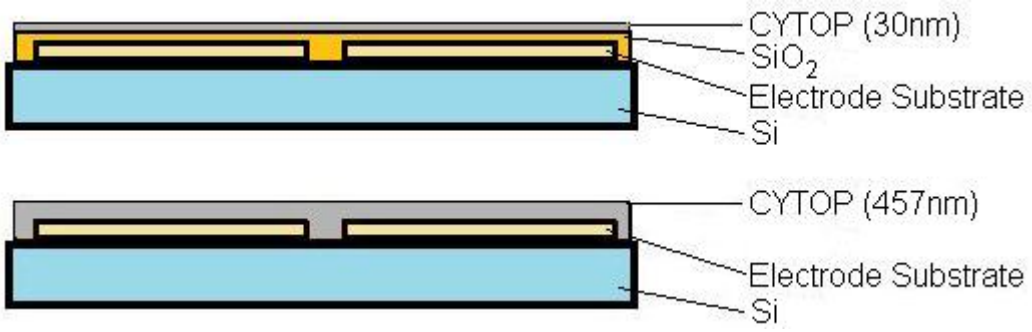
Cyclic Transparent Optical Polymer (CYTOP™) is a type of organic flouropolymer which belongs to an amorphous (non-crystalline) family that includes Aflas™, Lumiflon™, Fluorel™ and Kalrez™. Flouropolymers in general have similar characteristics: they are excellent thermal and electrical insulators; they have high chemical resistance and provide hydrophobic surfaces.[1] CYTOP™ in particular offers additional benefits due to its ring-like structure as shown below: the structure of the polymer gives CYTOP™ a transparency greater than 95% and solubility in specific perfluorinated solvents.[2] These additional benefits make CYTOP™ easy to apply, provide wider range of usage in current and future electronics.



http://www.bellexinternational.com/products/cytop/

There are three types of CYTOP™s, each one is classified based on the ending molecule which gives it unique properties for different applications. Type A (-COOH) can be applied to metal or glass and is transparent to visible light; Type M (-CONHSi) can be applied in one-step as a protective coating; and Type S (-CF3) offers UV resistance with no adhesion properties. Each type of CYTOP™ can be applied by either spin-coating, dip-coating, or potting and each can be repeated multiple times to increase the thickness.[3] In fact, CYTOP™ is an easy to handle fluoropolymer due to its deposition in air from it solution state.[2] It can be applied as a liquid solution, spin coated and then baked onto a substrate without much necessary preparations like other fluoropolymers.[3]

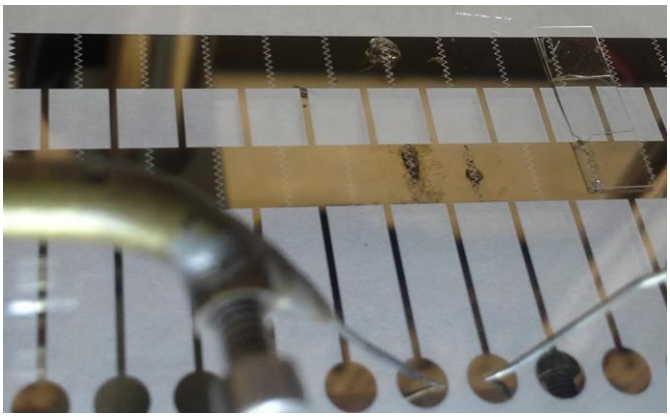
Electrowetting-on-dielectric (EWOD) which stems from conventional electrowetting (EW) takes advantage of the many properties provided by CYTOP™. CYTOP™ Type-M is coated on top of dielectric and electrode wafer to study the motion of different droplet solutions manipulated by the application of electric fields. The coating is usually applied as 30nm thin hydrophobic layer or thicker than 450nm for hydrophobic and insulating purposes. CYTOP™ has a permittivity between 2.1-2.2 which makes it an excellent but more expensive insulator.[2]



A 457nm layer of CYTOP™ resists a breakdown voltage of 450V at 1μA of current which is a dielectric breakdown field of 9.8MV/cm. The CYTOP™ layer is also subjective to different acid and alkaline droplet solutions with no chemical degradation. The hydrophobic characteristics are attributed to a low "root mean square roughness" of only 0.6nm formed by the layer of CYTOP™.[2] It provides a smooth and low energy surface for water and oil to "bead" and form a greater angle from the surface as shown below.[4] The contact angle for water is increased from 44^0 to 112^0 which allows for a greater degree of manipulation.[3]

The final characteristic of CYTOP™ that makes it a prime substance to use in EWOD is its transparency which allows the electrodes on the substrate to be seen. Different electrode alloys are tested in different solutions to find the best pair for longevity

applications. CYTOP^{TM}'s index of refraction of only 1.34 allows for a clear view of the substrate before and after testing as seen below.[3]



The properties of CYTOP^{TM} have provided great benefits to the field of EWOD. Current research is also focused on charge transport between dielectric-semiconductors to design "organic field-effect transistors (OFETs)." The cross-linking and monolayer structure of CYTOP^{TM} provides excellent chemical resistivity and low water adsorption which are key properties to minimizing trapping of impurities. [6]

References

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