



Vivion™

cyclic block copolymers

Enable Unlimited Possibilities



2 Key Technologies

Complete Hydrogenation

- Efficient complete-hydrogenation
- Ensured product quality

Anionic Polymerization

- Precisely controlled molecular weight
- Extremely low extractables



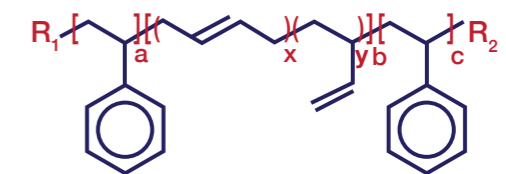
ViviOn™

Cyclic Block Copolymers (CBCs)

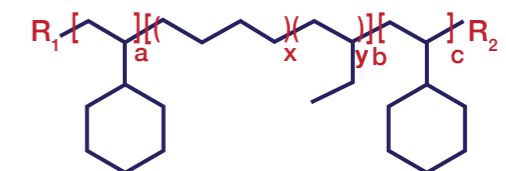
ViviOn™ is a family of novel cyclic block copolymers (CBCs), which are fully hydrogenated polymers based on styrene and conjugated dienes via anionic polymerization. This advanced material has remarkable thermal stability, excellent UV durability, extra-high transparency, low water absorption, low density and superb purity. These features offer the users of ViviOn™ with superior design flexibility, easy processing capability and low life-cycle costs. In addition, the flexibility of tailoring polymer micro-structure by adjusting the ratio of poly(cyclohexylethylene) (PCHE) and ethylene-co-1-butene (EB) provides ViviOn™ a wide range of properties from rigid plastics to soft elastomers.

Complete Hydrogenation Technology

Styrene-Butadiene Copolymers



Cyclic Block Copolymers



USI Corporation, one of the largest polymeric material companies based in Taiwan, has a long history in producing and selling PE and EVA. The company acquired the CBC technology in 2011 and initiated the world's first -ever CBC mass production line in Kaohsiung, Taiwan.

For more information, please refer to www.usife.com



1995
Initiation

2000
Fundamental research

2005
Application development

2011
USI -Technology acquisition,
product research and market
development

2018
USI initiated the world's first-
ever CBC mass production line
in Kaohsiung, Taiwan

2019
Developed optics, medical device and
consumer product applications

2020
Received the 17th National Industrial
Innovation Award

2021
Developed PE/PP packaging
application and high impact grade

2022
Started operation of USI
Corporation Process R&D Center

ViviOn™ Properties

Properties	Unit	Test Method (ASTM)	Standard Grade				High Impact Resistance	
			8210	1325	0510	0510HF	0510T	0510HT
General Properties								
Density	g/cm ³	D792	0.94	0.94	0.94	0.94	0.94	0.94
Water Uptake	%	D570	<0.01	<0.01	<0.01	<0.01	< 0.01	< 0.01
Melt Flow Rate (2.16kg, 230°C)	g/10min	D1238	35.0	1.3	0.5	1.3	1.1	0.9
Melt Flow Rate (2.16kg, 260°C)	g/10min	D1238	-	-	-	-	-	-
Optical Properties								
Refractive Index	-	-	1.51	1.51	1.51	1.51	-	-
Transmittance (380-760nm)	%	D1003	92.0	92.0	92.0	92.0	91.5	91.0
Haze	%	D1003	<1.0	<1.0	<1.0	<1.0	1.5	5.0
Thermal Properties								
Vicat Softening Temperature (1kg, 50°C/hr)	°C	D1525	109	125	116	114	113	108
Heat Distortion Temperature (0.455MPa, 2°C/min)	°C	D648	83	103	89	88	87	83
Glass Transition Temperature	°C	USI Method	115	128	120	120	119	115
Mechanical Properties								
Flexural Strength	MPa	D790	65	70	64	66	60	56
Flexural Modulus	GPa	D790	2.1	2.3	1.8	1.8	1.6	1.4
Tensile Strength (B.P.)	MPa	D638	35	37	36	35	35	25
Elongation	%	D638	7	14	20	15	16	100
Impact Strength (Charpy Notched)	kJ/m ²	D6110	2.6	3.0	5.0	5.0	12.0	20.0
Processing								
Injection Molding			☉	☉	○	☉	☉	☉
Extrusion Molding				☉	☉	☉	☉	☉
Injection Stretched Blow Molding					○	☉	☉	☉

ViviOn™
Cyclic Block Copolymers
(CBCs)

ViviOn™ Properties

Properties	Unit	Test Method (ASTM)	UVC Grade						New Grade	
			8210EUT	1325EUT	0510EUT	0510HFE	1325EP	0510FEP	1608	0645
General Properties										
Density	g/cm ³	D792	0.94	0.94	0.94	0.94	0.94	0.94	0.92	0.94
Water Uptake	%	D570	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Melt Flow Rate (2.16kg, 230°C)	g/10min	D1238	35.0	1.3	0.5	2.5	2.5	2.5	3.0	-
Melt Flow Rate (2.16kg, 260°C)	g/10min	D1238	-	-	-	-	-	-	-	6.0
Optical Properties										
Refractive Index	-	-	1.51	1.51	1.51	1.51	1.51	1.51	-	-
Transmittance (380-760nm)	%	D1003	92.0	92.0	92.0	92.0	92.0	92.0	91.5	91.5
Haze	%	D1003	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Thermal Properties										
Vicat Softening Temperature (1kg, 50°C/hr)	°C	D1525	109	125	116	114	125	114	93	148
Heat Distortion Temperature (0.455MPa, 2°C/min)	°C	D648	83	103	89	88	103	88	57	131
Glass Transition Temperature	°C	USI Method	115	128	120	120	128	120	112	146
Mechanical Properties										
Flexural Strength	MPa	D790	65	70	64	66	70	66	-	-
Flexural Modulus	GPa	D790	2.1	2.3	1.8	1.8	2.3	1.8	0.7	-
Tensile Strength (B.P.)	MPa	D638	35	37	36	35	37	35	38	45
Elongation	%	D638	7	14	20	15	14	15	280	3
Impact Strength (Charpy Notched)	kJ/m ²	D6110	2.6	3.0	5.0	5.0	3.0	5.0	6.0	1.7
Processing										
Injection Molding			☉	☉	○	☉	☉	☉	○	
Extrusion Molding				☉	☉	☉	☉	☉	☉	☉
Injection Stretched Blow Molding					○	☉		☉	○	

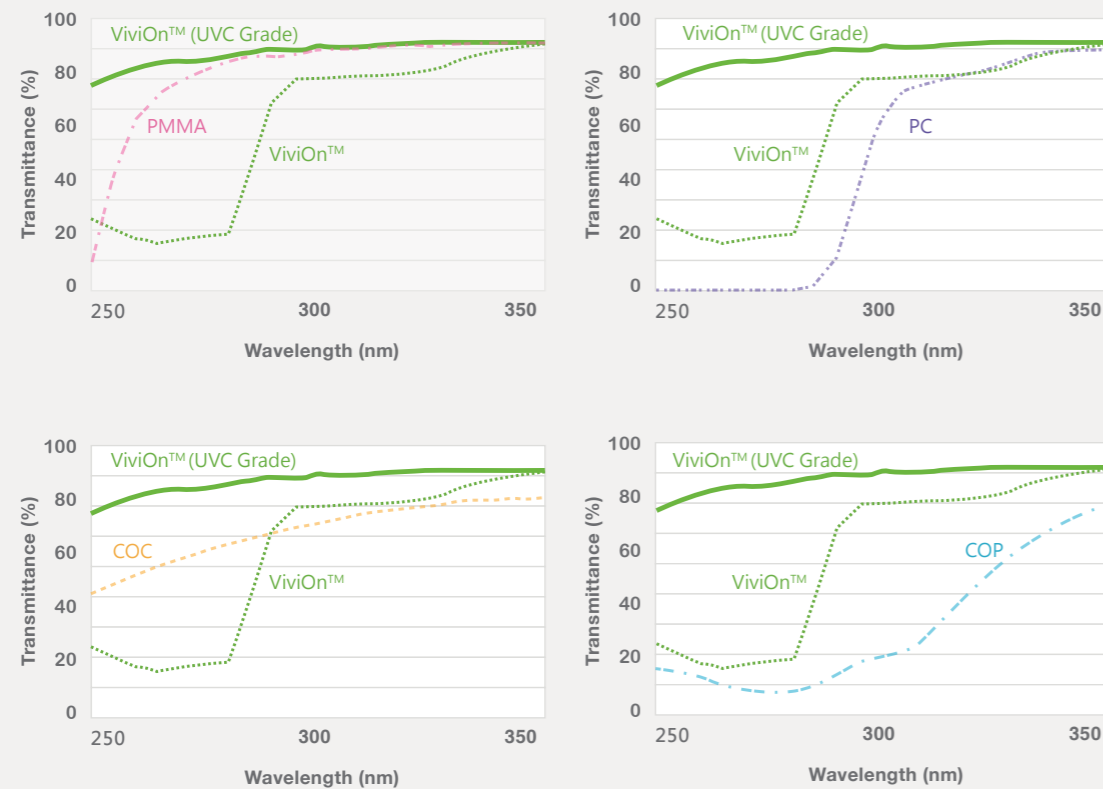
Optics

Improved brightness, clarity and viewing angle for your display

ViviOn™ is an innovative optical polymer with characteristics of low density, extra-high transparency, well-controlled light retardation, excellent UV durability, great chemical resistance, and low moisture uptake. Due to the unique chemical micro-structure, ViviOn™ can be processed advantageously in most optical fabrications including injection molding, extrusion and solvent casting.

Applications include: polarizing film, compensation film, and endoscope protective cover.

Superior High Transparency



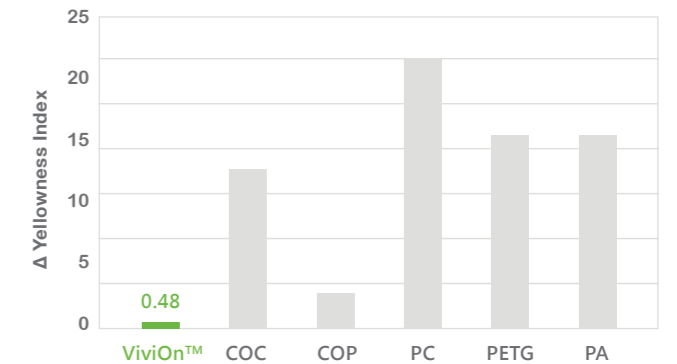
Outstanding Thermal Stability

Time/ Materials	ViviOn™	COC	COP
30 min			
60 min			

At 250°C oven, air



Excellent Weatherability / UV Durability



•ASTM G154
 Wavelength : UVA 340 nm
 Irradiation : 0.89 W/m²
 Test duration: 1000 hrs
 Each cycle include 8 hrs of UV exposure with uninsulated black panel temperature (60±3°C) and 4 hrs of condensation with uninsulated black panel temperature (50±3°C).



Electric Vehicle

Improved at high temperatures and more efficient.

ViviOn™0645 is renowned for its high purity and heat-resistant properties, which can effectively improve the heat resistance of polypropylene (PP) film capacitors.

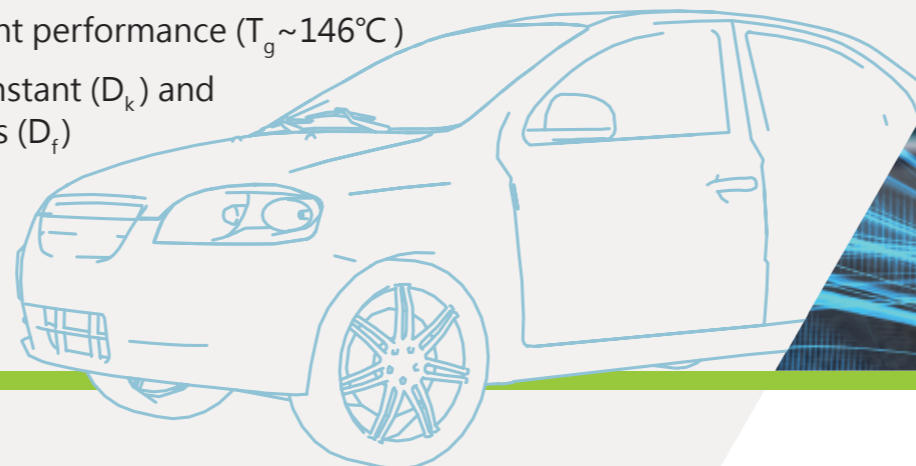
By proper incorporation of ViviOn™0645 into the traditional PP, the film capacitor can be made to meet the increasing demand for high heat-resistant capacitors. This integration effectively improves the dimensional stability of the PP film capacitor, especially under high temperatures.

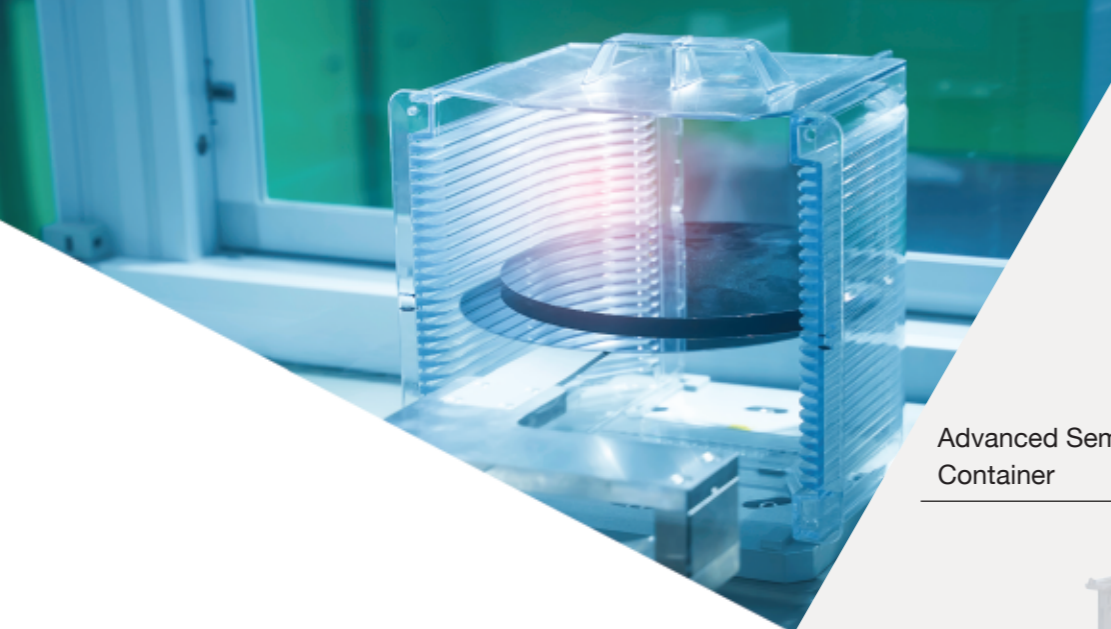
Key material for electric vehicle advancement

ViviOn™0645's heat-resistant performance can elevate electrical performance of PP film capacitors, which can help to produce smaller and more energy-efficient electric vehicles.

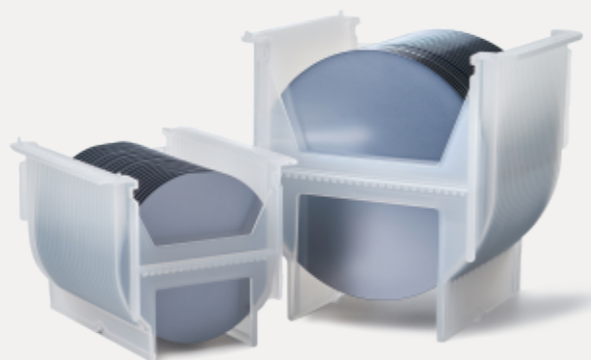
ViviOn™0645 features

- ✓ High purity polymer
- ✓ High heat-resistant performance ($T_g \sim 146^\circ\text{C}$)
- ✓ Low dielectric constant (D_k) and Low dielectric loss (D_f)





Advanced Semiconductor Container



IC Manufacturing Carrier

Clean & Exceed: Material with minimal contaminants for semiconductor manufacturing.

ViviOn™ has been analyzed through Ion Chromatography (IC), ICP-MS, and GC-MS by SGS Lab. Comparing with other engineering polymers, ViviOn™ has low metal ion concentration, low heavy metal content, and low volatile organic compounds (VOC), which brings low particle generation, low outgassing, and high purity. In addition, ViviOn™ possesses excellent chemical resistance, great abrasion resistance, high hydrolysis resistance, exceptional dielectric strength, and outstanding radiation resistance. The aforementioned features could be applied to semiconductor fabrication products, carriers and electric packaging containers, etc.

Regulation/Test	Test Details	Results
REACH (SVHC)	Substances of very high concern test (EU)	Passed
RoHS	4 types of heavy metals and 7 types of plasticizers.	Passed
Halogen Free	Fluorine (F), Chlorine (Cl), Bromine (Br), Iodine (I)	Passed

Lightweight

Light & Floating: Superior choice for eyewear device.

ViviOn™ displays low density floating property, high impact resistance, and Gamma/UV sterilizable, which makes it suitable for eyewear, e.g.: frame of sunglasses and sport glasses, medical safety goggles, etc.

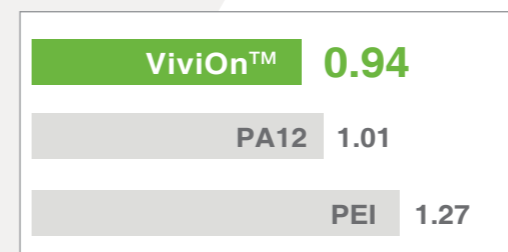


Low Density



High Impact Strength

Charpy Impact Strength (kJ/m²)



Medical Applications

Pure & Clean: An extremely clean and trustworthy material for medical devices

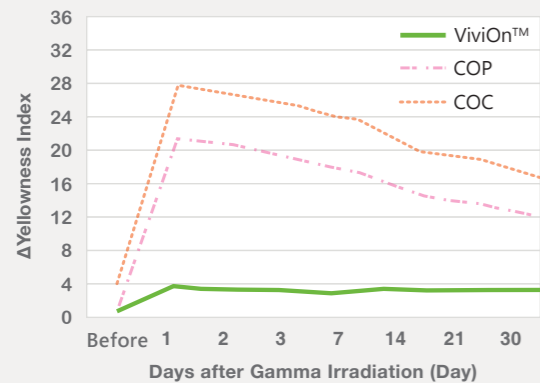
ViviOn™ is safe, reliable and durable for medical applications with features of extreme purity, good thermal stability, excellent UV durability, superb chemical resistance and outstanding clarity. The products made by ViviOn™ can be sterilized using Gamma and E-beam radiation, Ethylene Oxide Gas (EOG), providing medical professionals ease of use and compatibility.

ViviOn™ passes selected chapters of ISO10993 biocompatibility, US Pharmacopeia <88> Class VI and <661>, European Pharmacopeia 3.1.3, as well as JP Pharmacopeia 7.02. The material is listed in the U.S. FDA Type III Drug Master File 32470.

Applications include: pre-filled syringe, vial, medical packaging, etc.

Low color shift after Gamma irradiation

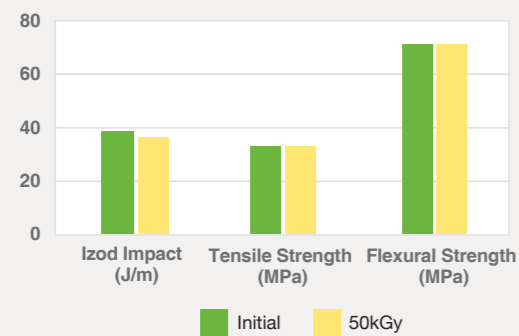
Gamma irradiation 50kGy (Sample thickness: 6mm)



Days after Gamma irradiation	ViviOn™	COP	COC
Before			
1 Day			
2 Days			
5 Days			
7 Days			
30 Days			

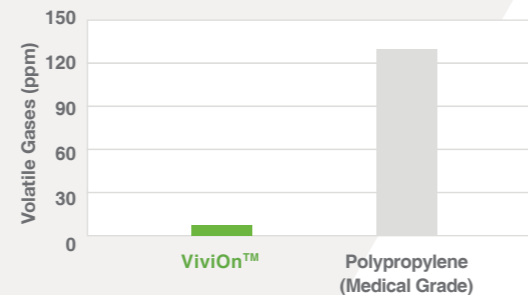
Mechanical properties after Gamma irradiation

Mechanical properties were measured before and after 3 weeks of Gamma irradiation.



Extremely Low Outgassing

Test condition: heat at 80°C for 2hrs, then measure volatile gases by headspace GC/MS.



Regulation/Test	Test Details	Results
BPA Test	SGS Bisphenol A test	Not Detected
DMF	US FDA Drug Master File for pharmaceutical application	No. 32470
ISO10993 – 4/5/6/10/11	Hemolysis, Cytotoxicity, Muscle Implantation, Intracutaneous Irritation, Sensitization, Acute Systemic Toxicity	Passed
USP <88> Class VI	Acute System test, Intracutaneous test, Implantation test	Passed
USP <661>	Non-Volatile Residue, Heavy Metals (as Pb), Buffering Capacity	Passed
JP Pharmacopeia 7.02	Residue on Ignition, Heavy Metals (Pb, Cd, Sn), Foaming test, pH Value, KMnO ₄ Reducing Substances, UV Spectrum, Residue on Evaporation	Passed
European Pharmacopeia 3.1.3	European Pharmacopoeia 3.1.3	Passed
Extractables	Reflux, Sonication and Closed vessel extractions.	Negligible

Sterilization Method	
Gamma Radiation	✓
E-beam Radiation	✓
Ethylene Oxide Gas	✓



Pre-filled Syringe



Vial

Bio-diagnostics

Accurate & Reliable: The material-of-choice for bio-diagnostic devices

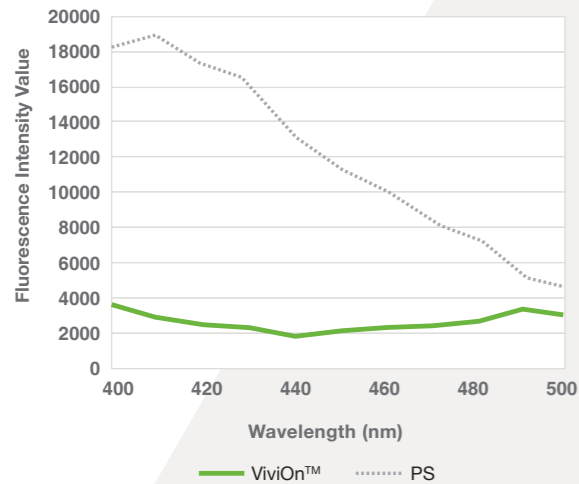
ViviOn™ presents extreme cleanness and exceptional performance in its optical properties: higher UV transmittance and lower autofluorescence than other plastics to increase the accuracy and reliability of the analysis.

Applications include: cuvette, microplate and microfluidic chip (bio-chip) for UV and/or fluorescence detection.



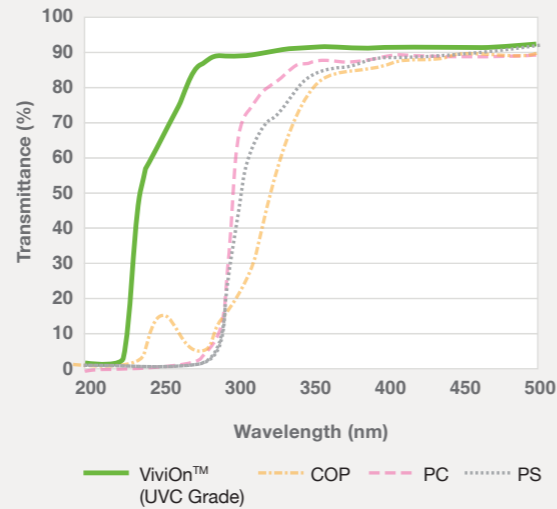
Low Autofluorescence

Excitation: 350 nm, sample thickness: 1 mm



High UV Transmittance

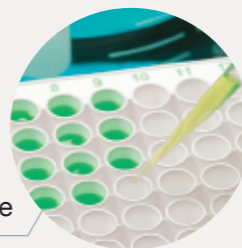
Sample thickness: 1 mm



Microfluidic Biochip



Cuvette



Microplate



	Solvent	Resistance
Acid	Hydrochloric acid 36%	○
	Sulfuric acid 40%	○
	Acetic acid > 94%	○
	Nitric acid 65%	○
Alkali	NaOH 50%	○
	Ammonia solution 35%	○
Alcohol	Methanol	○
	Ethanol	○
	Isopropanol	○
Ketone	Acetone	○
	Methyl Ethyl Ketone	○
Others	DMSO	○
	Silicone oil	○
	Ethylene glycol	○

ViviOn™ resin & tensile bar specimen were immersed in the chemical or reagent for 2 days at room temperature, the specimen's weight loss and mechanical reduction were then measured. Resistant (○): weight loss < 1% and elongation at break% did not change significantly; Not Resistant (✗): weight change >5% or elongation at break% reduced by > 50%.

Accurate & Reliable

Deep Ultraviolet (UVC) Disinfection

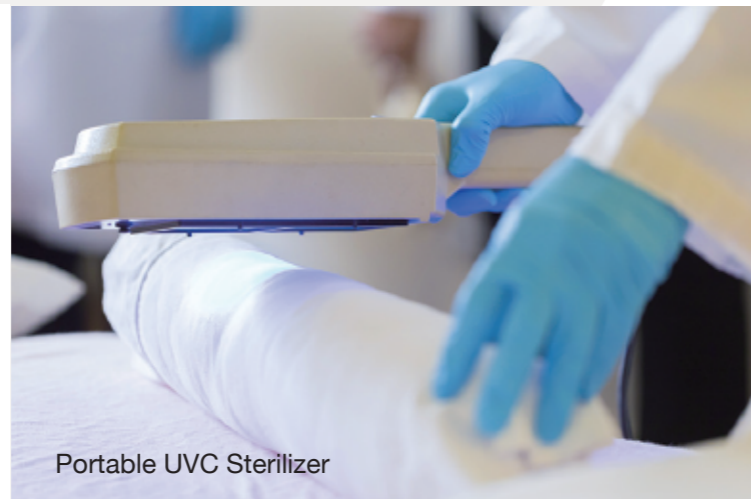
Exceptional processability for a safe disinfection device

ViviOn™ is a medical grade plastic material with high UVC transmittance and durability for deep ultraviolet (UVC) applications. In comparison with other plastics, ViviOn™ maintains high UVC transmittance and a glass-like appearance under long-term UVC exposures, which makes it a suitable choice in portable UV sterilizer.

ViviOn™ can be fabricated into sheets and parts for UVC disinfection devices through conventional processes, e.g., injection molding, extrusion, etc. With its exceptional processability, superior chemical resistance, and low density, ViviOn™ provides a versatile flexibility in product design.



UVC Sanitizer Box



Portable UVC Sterilizer

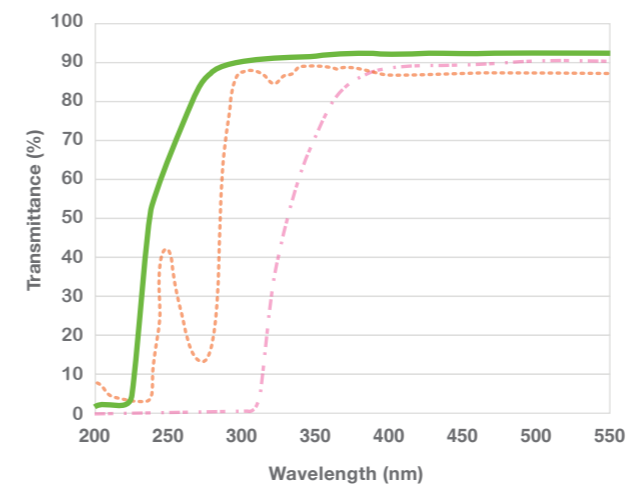


UVC exposure 6,500,000 mJ/cm² (65,000 kJ/m²)
 = [UVC irradiance 20 mW/cm²] * [Exposure time 90 hrs] = [UVC irradiance 2 mW/cm²] * [Exposure time 900 hrs]



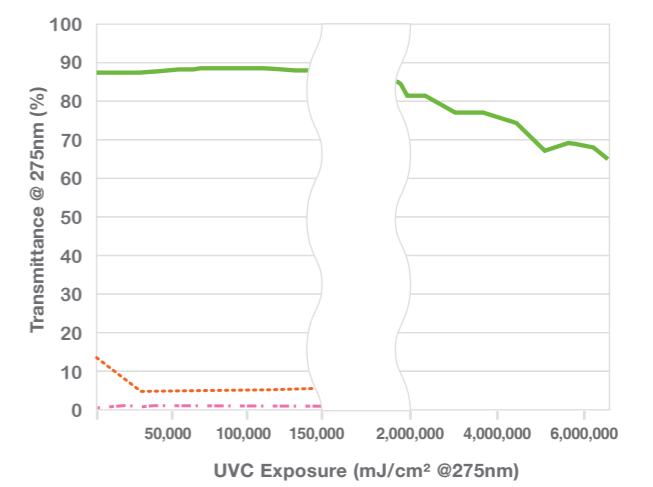
High UVC Transmittance

Sample thickness: 1mm



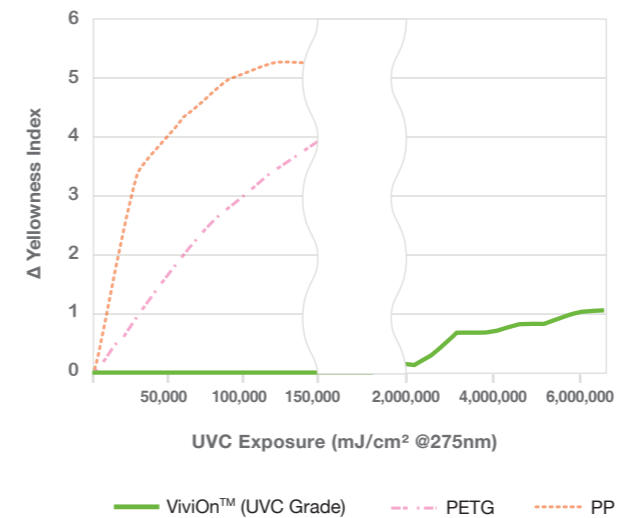
Substantial UVC Durability

Sample thickness: 1mm

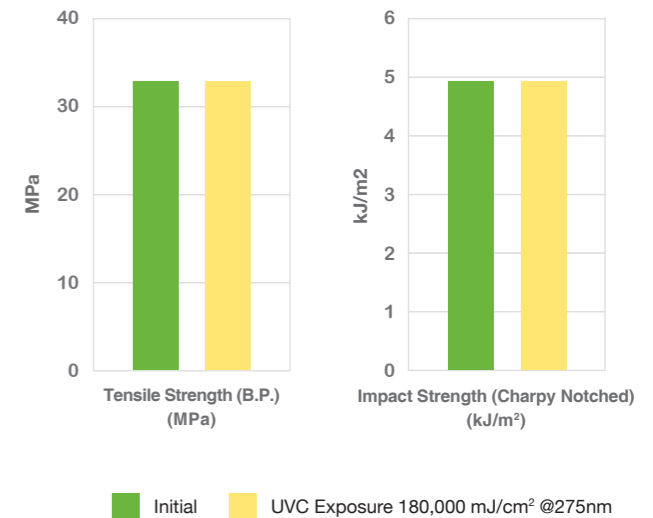


Low Color Shift after UVC Exposure

Sample thickness: 1mm



Mechanical Properties after UVC Exposure





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www.usife.com

+886 2 8751 6888, ext:6724

4th Floor, No. 39, JiHu Road, NeiHu District,
Taipei 11492, Taiwan(R.O.C.)

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