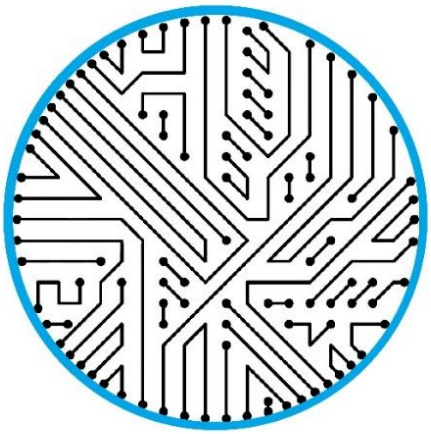
Datasheet Puretecs Peco EGC FP

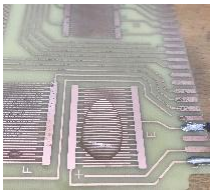
Peco EGC is an ideal, **PFAS-free alternative to fluorinated coatings** such as Purocoat 17/02!

Peco EGC surface coating is a ready-to-use, clear liquid dissolved in a non-flammable solvent.
The coating creates a surface with good anti-moisture, anti-surface diffusion and anti-corrosion properties. With a low surface energy, liquids such as water, lubricating oils and silicones can drain freely from the surface while the protective film remains intact.
Peco EGC is transparent, smooth and forms a hard protective layer and does not change the color of most substrates. Peco EGC contains UV tracers that allow control of the coating result.

In electronic applications, contacting of metallic contacts is possible despite coating. Test probes can generally be used on all contacts. Masking of contact surfaces is normally not necessary.
Peco EGC is only very slightly electrically conductive in its liquid state and not at all electrically conductive in its dry state, so that even button cells that are loaded with voltage can be coated without any problem.

The use of Peco EGC in the immersion process requires control of the solids concentration.
With a controlled solid concentration, the same layer thickness can always be coated on the electronic components



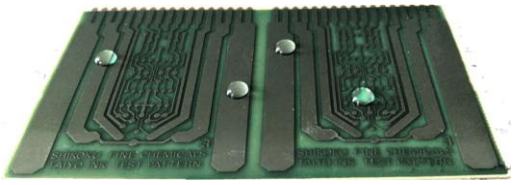


Typical applications :

- Corrosion protection
- Electronic assemblies
- Anti fouling
- Sensors
- Power supplies

Characteristics:

- Prevents corrosion
- High lubricity
- Low friction coefficient
- Permanently resistant to hard abrasion
- Hydrophob
- Oilophobic
- Does not migrate
- Reduces pollution
- Flexible due to thin layer thickness
- Durable and excellent resistance to UV light
- Non-stick properties – for maximum protection against soot, dust, mud, salt residue, limescale, water stains and oils
- Apply in <10 minutes
- Dries very quickly at room temperature
- Non-flammable, non-toxic, not a hazardous substance!



- The use of Peco EGC coatings in body-invasive assemblies is not permitted! Peco EGC must not be used for products that are introduced into the human body (for medical purposes), such as syringe needles.
- Peco EGC is based on hydrocarbon siloxanes
- The solvent is moderately aggressive to plastics, skin and eyes. Read the safety data sheet and follow all protective measures to prevent injuries.
- Sale and use is only for professional, commercial users! Not intended for private use!

Peco EGC offers unrivalled environmental and health properties. The material is free of heavy metals and PFAS, thus meeting the highest standards of safety and sustainability.
REACH and RoHs compliant.
The solvent (92%) consists of a non-flammable, fluorinated liquid. The dried protective layer of Peco EGC does not contain fluorine. All components of Peco EGC are free of PFAS!

The solvent is a halogenated hydrocarbon, which is a solvent according to Section 1 Paragraph 1 of the 2nd BImSchV. The use of Peco EGC FP is therefore excluded in surface treatment systems according to the 2nd BImSchV. This only applies to the territory of the Federal Republic of Germany.

Peco EGC as process fluid

Typical physical properties

Appearance	Clear, colorless liquid
Odor	strong, characteristic, similar to white spirit
Solvent content	60 — 92% wt .
Solvent:	Fluorinated, PFAS-free
Specific density at 20 °C	1.39 g/cm³
Viscosity at 25°C	0.57 cST
Boiling point of the solvent	54°C
Electrical conductivity	4.2 pS /cm
Flash point	none
Relative evaporation value (ether = 100)	64

Environmental properties

Ozone depletion potential (ODP)	0.0 (1 CFC-11 = 1.0)
Global warming potential (GWP)	<1 (CO_2 = 1, 100 years ITH)
Labelling	GHS07
Dangerous goods	no
Danger	Not toxic to humans in typical use
Exposure of persons to solvent vapour in the air	max 250 ppm (8h, COM)

Processing instructions

Process	Spraying / dipping in bath
Dive times	No minimum duration. Bubble-free diving
Ascent speed	Maximum 10mm/s
Drying times	approx. 2-10 minutes. Depending on the geometry
Special features	Avoid scooping components

The liquid has a low electrical conductivity; please bear this in mind when submerging charged battery packs or batteries. In most cases, the conductivity is low enough to coat batteries and battery packs safely.
The surface must be clean and dry before coating. The cleanliness (especially the absence of grease) of the surface is important for the success of the coating!
Peco EGC can be applied by either dipping or spraying.
For a dip process, dip the part to be coated in Peco EGC for a few seconds, allow it to drain, and then allow the surface to dry.
Peco EGC is dry to the touch after a few minutes at room temperature. At room temperature, Peco EGC is completely cured after 12 hours at the latest. At 100°C, the curing time is only around 15 minutes and then it is completely cured. Peco EGC does not need to be thermally post-cured if the longer waiting time is acceptable.
The assembly can be processed further if it is dry after a few minutes; there is no need to wait for the curing time. The curing time only provides full protection against moisture.

Natural concentration change

Peco EGC is supplied in a ready-to-use concentration of 4%. If Peco EGC is poured into a container or bath that is not tightly sealed, the solvent content in Peco EGC will be lost through evaporation over time. The solvent contained evaporates very easily and quickly.
Although solids are removed from Peco EGC during application in order to ultimately coat the components, the proportion of evaporating solvent far outweighs this in most cases. This means that over time the concentration increases from the original 4% solids content to higher values. The total amount of Peco EGC liquid decreases.

Concentration measurement manually

What is needed?

1. Precision scale with a display accuracy of 0.001 g
2. Weighing bowl – disposable item made of aluminium foil with a diameter of
3. 5 or 10 ml syringe, reusable

How do we proceed?

1. Scale is switched on for at least 5 minutes. Without load, press tare display to set to 0.000 g.
2. Place bowl and empty syringe on top and note weight. (E2)
3. Fill the syringe, place it on the scale together with the bowl and note the total weight. (E3)
4. Carefully empty the syringe contents into the bowl and set the syringe aside.
5. Allow the bowl to dry at room temperature for about 10 hours - preferably overnight.
6. Place the dry bowl and syringe back on the zeroed scale and note the weight. (E6)

How do we get the result?
The calculation is done by subtracting the tare weight from 2 from the gross weights from 3 and 6, and comparing the two results to determine the percentage.

$\frac{E6-E2}{E3-E2}\ x\ 100 = Prozentanteil\ des\ Feststoffes$ w

When emptying the syringe into the bowl, some liquid tends to splash over the edge of the bowl. To avoid this, you can poke a small hole in the top of the syringe and then pull the syringe plunger upwards over the hole to allow the liquid to slowly slide onto the bowl.

Refilling Peco EGC into an existing coating bath

Once the current concentration w has been determined, an existing coating bath can be adjusted to the desired target concentration of 4% by refilling Peco EGC Concentrate (10% concentrate) or Peco EGC Solvent (pure solvent).

- If the value is lower than the desired target concentration of typically 4%, then Peco EGC Concentrate (40% concentrate) is added to add more solids to the existing coating bath and raise the value:
  nk : amount of Peco EGC Concentrate (concentrate) to be refilled in liters
  b : amount of existing coating bath in liters
  w : value of the concentration in the existing coating bath in %
  z : target concentration (typically 4) in %

$$\boldsymbol{nk = b * \frac{z - w}{40(\%) - z}}$$

- If the value is higher than the desired target concentration of typically 4%, then Peco EGC Solvent (pure solvent) is added to dilute the existing coating bath and reduce the value:
  nv : amount of Peco EGC Solvent (thinner) to be refilled in liters
  b : amount of existing coating bath in liters
  w : value of the concentration in the existing coating bath in %
  z : target concentration (typically 4) in %

$$\boldsymbol{nv = b * \left(\frac{w}{z} - 1\right)}$$

instead of the calculated volume with a liter measure when refilling, remember that 1 liter ≈ 1.39 kg!

Consumption of Peco EGC during coating

During coating, the solids content in Peco EGC is consumed as it is deposited on the surfaces of the components and thus becomes less and less in the dip bath . In addition, solvent is consumed as it evaporates into the environment. Evaporation also occurs to a lesser extent without coating if Peco EGC is not stored in closed containers.

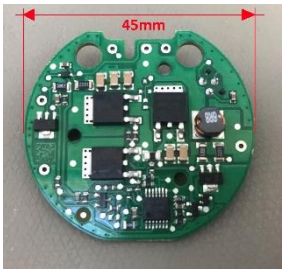
The consumption of the solid portion depends solely on the surface to be coated. If many components with a large surface area are coated, the solid portion is consumed even faster.

The consumption of the solvent depends on many factors, such as the tank opening size, air movement, cooling capacity of a system, etc.

Purely mathematically, an area of 92m² can be coated with 1 kg of Peco EGC.

In practice, it has been shown that calculating the surface area of the assembly is too imprecise to determine the actual consumption. It is better to weigh several assemblies before and after coating to the nearest 1 mg and calculate an average value to determine the consumption of the solid portion of the Peco EGC.

Example calculation:



Mixed assembly with 45mm diameter.
Production: 4500 pieces per working day.

Weight before coating: 7.938g
Weight after coating with Peco EGC: 7.946g

Consumption of solids: 0.008g (difference)

When coating in a system:

Solids consumption per assembly	0.008g
Assemblies per working day	4500
Solids consumption per working day	36g
Solvent consumption per working day	1000g
Basic solvent losses of the plant per day	100g
Typical factor of solvent consumption in relation to solids consumption (statistical value)	**25**
Consumption of Peco EGC Concentrate per working day	90g
Consumption of Peco EGC Solvent per working day	946g
Working days per month	21
Peco EGC Concentrate 7kg bottle	**0.27 pieces**
Peco EGC Solvent 7 kg bottle	**2.84 pieces**

36g of solids are used per day to manufacture this assembly. This results in a monthly consumption of approximately:

- ¼ bottle Peco EGC Concentrate 7 kg (40% concentrate)
- 2-3 bottles of Peco EGC Solvent 7 kg (solvent)

With this amount of material, a total of 94,500 of these assemblies can be coated over a month.

Preparation of the assemblies to be coated

In general, no special preparation of the assemblies is required. Cleaning the assemblies before coating is advisable as it increases the quality, but is not absolutely necessary. The adhesion of Peco EGC is good enough to stick to almost any type of surface and form a coating.
However, avoid coating assemblies that contain lubricants (on mechanically moving parts), especially silicone lubricants, as these will dissolve in Peco EGC and contaminate it.
The solvent from Peco EGC has a kB value of 44 and therefore has the side effect of a comparatively strong cleaning effect on the assembly.

Apply Peco EGC without a machine

Peco EGC (4%) can be used in containers as well as in systems for sporadic applications. Stainless steel, glass and many common plastics are best suited. The container should have a tightly fitting lid, as the solvent is very volatile and otherwise evaporates very quickly. Make sure that you only keep the container open when using it. If the Peco EGC is not to be used for a long time, it is best to store it in the original bottles. Immerse the entire assembly in the Peco EGC and ensure that all air bubbles can escape. You can then remove the assembly from the Peco EGC and let it drip off, ideally at an angle over the container. Watch out for nests in the assembly from which the Peco EGC liquid may not be able to drain; e.g. plug sockets without drainage channels. In this case, tilt the assembly accordingly. If no more drops fall and the coating is largely dry, the assembly can be processed immediately. Make sure there is sufficient ventilation, as the coating will continue to evaporate for a while. Pay attention to the solids concentration. The concentration of Peco EGC can be adjusted by adding solvent . Remove dirt from the surface of the Peco EGC and the edge of the container from time to time. Peco EGC can also be easily cleaned using a paper filter.

Minimize evaporation when applied manually

Be sure to keep Peco EGC in open containers only for as long as necessary. Immediately after use, pour it back into the original bottles and close the lid tightly.
In any case, avoid any kind of draft, open windows, fans or active extraction. Moving air promotes evaporation many times over. Use a container that is as tall and narrow as possible; the smaller the opening at the top, the smaller the evaporation losses. Whenever possible, immerse electronic components vertically and not flat.
(Peco EGC can remain permanently in immersion coating systems.)

No PFAS content

The solvent in Peco EGC is chlorotrifluoropropene , a liquid that contains fluorine but is not a PFAS (per- and polyfluorinated chemicals) as defined by the OECD and the ECHA. Peco EGC therefore contains no PFAS in either its liquid or dry state.

Compatibility with plastics

The solvent in Peco EGC has a high kauri-butanol value of 44. Accordingly, plastics could be attacked by the solvent. Due to the **very short immersion, this is not a problem with most plastics** , but in individual cases it is important to check beforehand whether the electronic assembly is suitable for this. Stickers and labels can also be affected. Metals of any kind do not typically pose a problem when in contact with Peco EGC.

	5 minutes immersion at 54°C			3 days immersion at 54°C		
material	**Mass change [%]**	**Swelling [%]**	**Extractables [%]**	**Mass change [%]**	**Swelling [%]**	**Extractables [%]**
Polyvinyl chloride brittle	1.6	0.2	<0.1	**37.8**	7.2	3.2
Polyvinyl chloride soft	**12.1**	1.4	4.8	-2.3	-6.3	**31.6**
Polyethylene (HP)	0.1	0.2	<0.1	3.5	0.9	<0.1
Polyethylene (LP)	0.7	0.6	<0.1	6.3	1.6	0.1
Polypropylenes	0.1	0.2	<0.1	7.7	1.7	0.2
Polystyrene	Dissolved					
Acrylic	Dissolved					
Polycarbonat	Dissolved					
ABS	Dissolved					
Polylactide (PLA)	Dissolved					
PTFE	<0.1	0.4	<0.1	0.3	0.3	<0.1
Epoxy (FR)	<0.1	<0.1	<0.1	0.2	0.2	<0.1
Nylon6	<0.1	0.2	<0.1	-0.2	-0.2	<0.1
Nylon66	<0.1	0.3	<0.1	0.3	0.3	<0.1
Polyethylene telephthalate	2.5	0.2	0.4	2.3	2.3	<0.1
Polyethylene sulfide	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Natural rubber	n/a .	n/a .	n/a .	**13.9**	2.4	**10.8**
Urethane rubber	n/a .	n/a .	n/a .	**197.4**	**36.1**	0.3
Isobutylene -Isoprene rubber	n/a .	n/a .	n/a .	2.8	-1.1	13.2
Fluoroelastomer	n/a .	n/a .	n/a .	**113.1**	**31.3**	3.2
Chlorosulfonated polyethylene	n/a .	n/a .	n/a .	**29**	5.7	**12**
Silicone rubber	n/a .	n/a .	n/a .	**132.3**	**25.4**	2.4
EPDM	n/a .	n/a .	n/a .	**14.3**	1.8	**12.2**

Example case: A mixed electronic assembly was immersed in the resting solvent for 18.5 hours (at room temperature). The electronic assembly has no noticeable change, only the soft support adhesive on the sides of the large blue capacitor has dissolved.

Note: A dipping time of <30s is sufficient for the coating process . This means that the dipping process is expected to have significantly less impact on plastics!

Before:

After (18.5h):

Peco EGC as dried coating

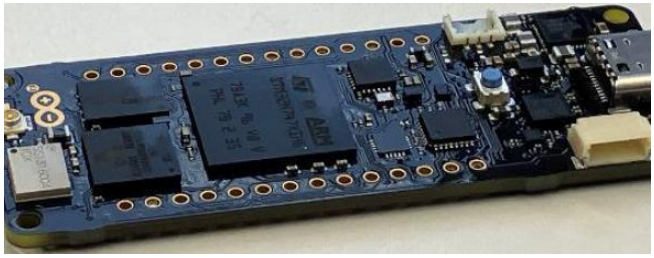
Typical physical properties

Thermal stability of the dried	film -40°C to **+400°C**
Density	0.8 g/cm³
Contact angle	>100° (water)
	>50° (mineral oil)
Roll angle	<40° (water)
	<5° (mineral oil)
Layer thickness/film thickness	~500nm
Dielectric strength	>2500 V/mil
Dielectric breakdown voltage, per ASTM D149	3000 V/mil
Dielectric constant @30% RH per ASTM D150	3.0 (1kHz)
Dissipation factor @30% RH per ASTM D150	0.002 (1kHz)
Ageing and UV resistance	No yellowing, as good as glass
	>233 kWh/m², 395nm average wavelength
Flammability according to UL-94	V-0

A coating with Peco EGC is homogeneous, crystal clear, wafer-thin, UV-resistant, permanently flexible, very temperature-resistant and hardly ages.
This example shows an aluminum substrate that was coated vertically using the dip coating process.

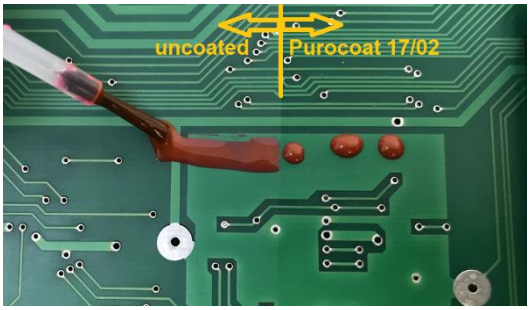
Handling of the finished coated assemblies

Assemblies coated with Peco EGC are covered with a protective film approximately 500 nm thick. This is permanently flexible and can withstand mechanical stress to a certain extent. After it has dried completely (a few minutes), the assembly can be easily touched by hand or held by clamping tools. Avoid scratching, strong rubbing and bulk materials.
When dried at room temperature, the assembly is fully load-bearing after 12 hours at the latest and is also suitable for climatic tests.



Test coating

A simple test to see if the coating has been applied can be done with a test ink. The test ink is set to a certain surface energy and indicates whether the surface is above or below this value.



Use a test ink with the value **30mN/m** to have a good distinction between uncoated and coated surface.
Use the brush to apply some of the test ink to the surface.

- **If the test ink contracts and cannot form a closed film, the surface is coated**
- **If the test ink remains as a closed film on the surface, the surface is not coated**

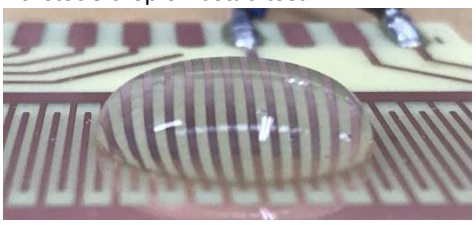
The test ink can then simply be wiped off with a dry, soft cloth.

Hardness test (Staedtler Mars Lumograph calibrated pencil set)

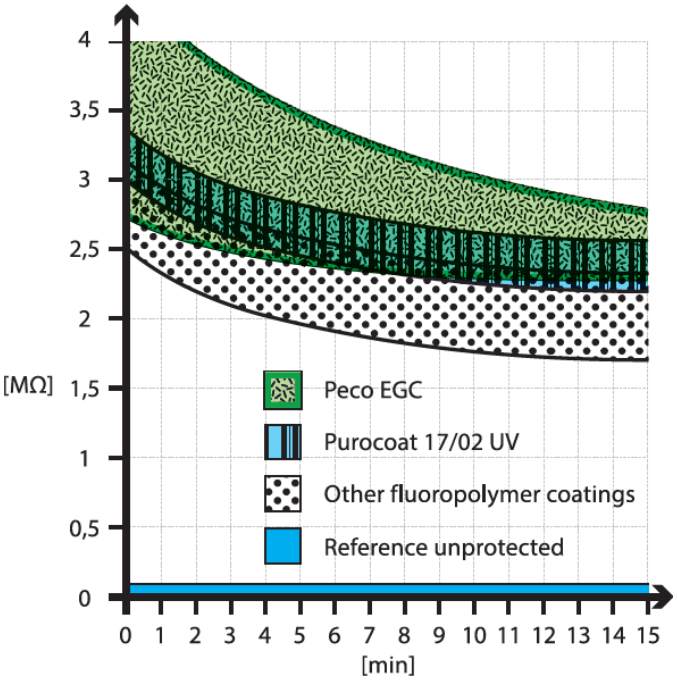
500 grams weighted pencil	7-8H hardness
750 grams weighted pencil	6H hardness
1000 gram weighted pencil	4H hardness

PDB Test

Puretec's drop on board test:



A 0.5 ml drop of drinking water is placed on the comb structure E of the IPC test board using the pipette and the electrical resistance is then measured over a period of 15 minutes.
The measurement is carried out cyclically every 2 seconds with a test voltage of 2.13587V.
The measurement result is a resistance curve that decreases slightly over time. A high value corresponds to a high level of protection.



Peco EGC is in the upper range, even above fluoropolymers. A slightly better protective effect than with fluoropolymers can be expected.

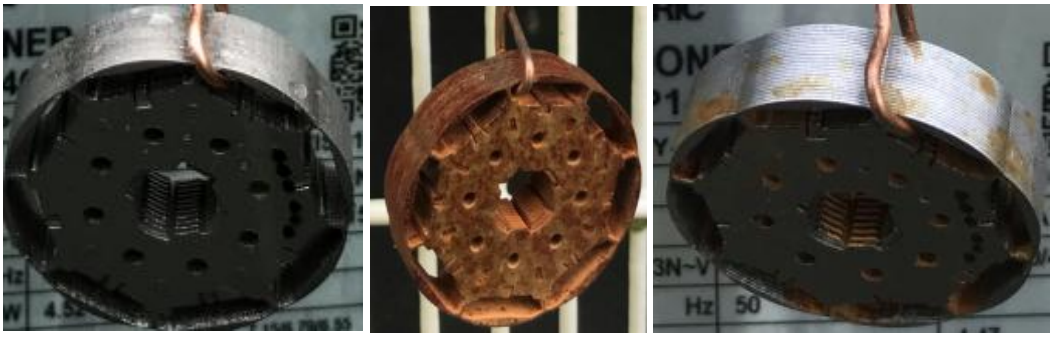
Corrosion protection

A protective layer with Peco EGC offers very good protection against corrosion (compared to other ultra-thin coatings).

Example case of copper sheet:

Start | 72h in 5% salt water at 65°C Uncoated | 72h in 5% salt water at 65°C Coated with Peco EGC

Example iron stator package :



Start | 105 days of outdoor weather Uncoated | 105 days of outdoor weather Coated with Peco EGC

Migration and contact glazing

Migration (independent movement of the coating material across the surface) is not to be expected as Peco EGC hardens and crosslinks.

When coating open relay contacts and other power-carrying contacts, it can happen that an electrical spark is created when the contact opens and the Peco EGC coating itself converts into silicate at the contact point. Silicate can cause the contact to become isolated and no longer electrically conductive (contact glazing). This effect can be avoided by using wash-tight relays.

Layer thickness measurement

A dried layer of Peco EGC applied in an immersion bath has an average layer thickness of ~500nm. The layer thickness is not exactly the same everywhere, but varies between approximately 400 and 600nm. This is mainly due to the run-off effects when pulling out of the immersion bath .

Scanning electron microscopy (SEM):

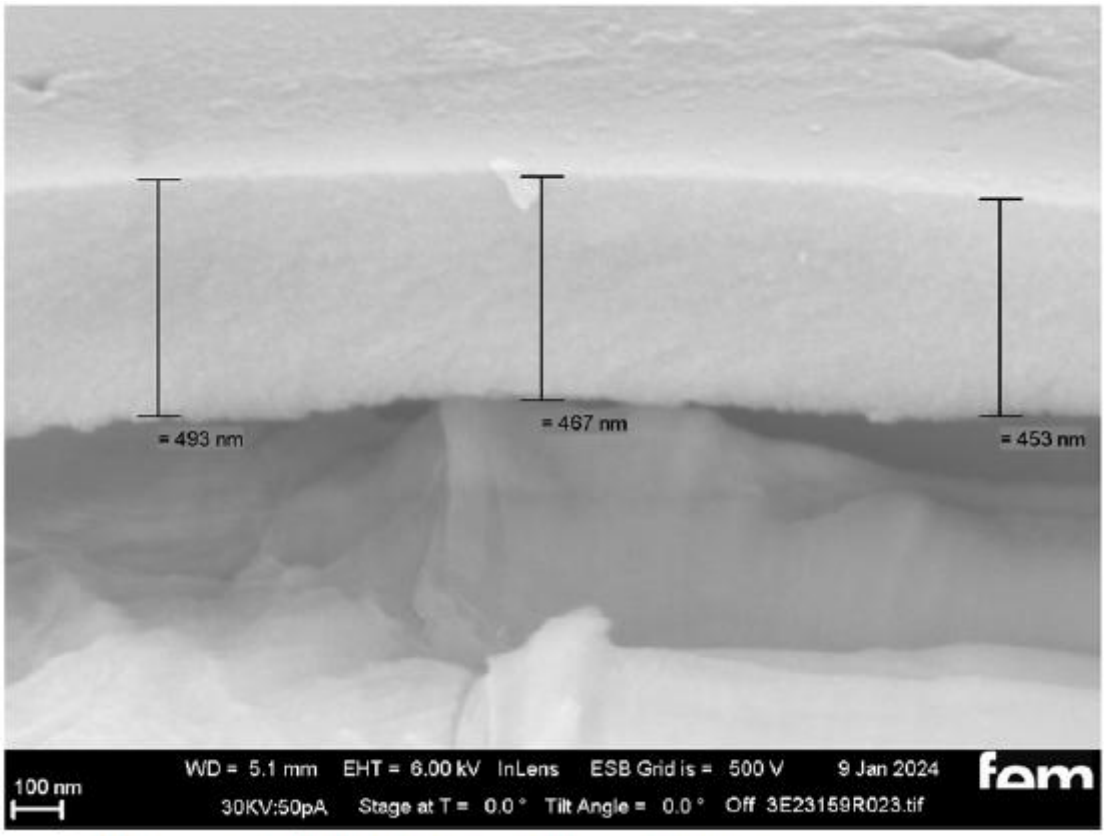
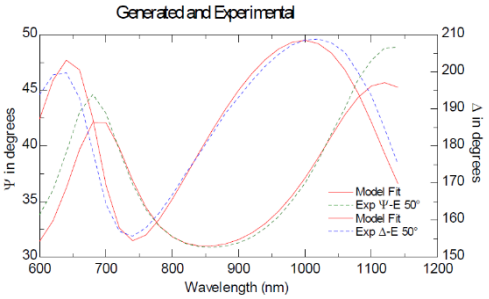


Abb. 7: Probe 1, Peco EGC auf FR4, Bruch, Detail, Schichtdicke

Scanning electron microscopy (SEM) can be used to create images of the very thin layer. To do this, the coated carrier must be frozen and broken (cryofracture) in order to be able to image a fracture edge with the dried Peco EGC layer. Please note that the layer thickness is influenced by the SEM measurement method and can shrink slightly. The images (image above) show the average layer thickness of a dried Peco EGC layer of ~500nm.

Ellipsometric thickness determination:



The layer thickness can also be determined by ellipsometric thickness determination using an appropriate measuring device. When measuring with ellipsometry, it must be noted that this can only be carried out on a defined surface (not on a PCBA) on an area of approximately 1mm². Compared to SEM, the process is much less complex.

In practice (production), it has proven to be a good idea not to measure the layer thickness, as this is too complex and costly. Since there is a direct connection between the layer thickness and the solids concentration of the Peco EGC, it is **perfectly sufficient to continuously monitor the solids concentration as a process variable**

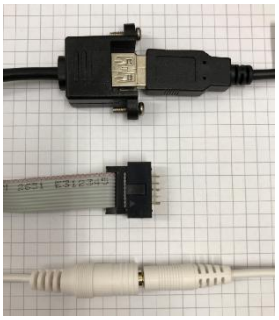
IPC Compliance

Peco EGC is compliant with IPC-CC-830C (Revision C) as Type UT (Ultra-Thin Coatings).

Electrical contactability

Peco EGC forms a protective layer that is designed to provide good protection against environmental influences, but still allows contact to be made with connectors, switches, relays, needle adapters, etc. In general, all types of metallic contacts do not pose a problem in terms of contactability after coating.
It is difficult to detect an increased contact resistance in typical connectors such as USB connectors, post connectors and jack plugs.
To ensure contactability , you must still test your assembly with the Peco EGC coating once to rule out rare eventualities.
The following connections can generally be problematic:

- Conductive rubber (elastrometric connectors)
- Silicone switch mats
- Edge card connectors



Increase in contact resistance after coating with Peco EGC after first plugging:

USB connector type A:	<0.03 Ω
Pin header connector “Molex”:	<0.05 Ω
3.5mm gold-plated jack plug:	<0.03 Ω

Measurements were performed with ohmmeter Agilent 34405A.

Repairability and recoating

Coatings with Peco EGC can be soldered through without any problem. The strong heat from the soldering iron partially destroys the coating and the combustion products could be slightly toxic. Always use an extractor when soldering through.
To apply a new coating of Peco EGC, use a pipette to add a drop of liquid Peco EGC to the affected area and allow it to dry at room temperature.

Remove Peco EGC

A dried coating with Peco EGC can no longer be removed with Peco EGC Solvent. No other solvent is known that can remove the coating. Removal by mechanical processing such as sandblasting is possible.

General

Dispose of Peco EGC

Liquid Peco EGC must be disposed of properly. It must not be discharged into wastewater or waterways. Dried Peco EGC can be disposed of in the general waste.

Dispose of packaging and bottles

The packaging and the bottles are recyclable. Please dispose of the cardboard packaging as waste paper and the aluminum bottles as aluminum or non-ferrous metal scrap.
Please note that Puretecs is unable to refill the bottles . Unfortunately, returning, checking and rinsing the bottles is not cost-effective. However, the bottles can be used to store Peco EGC at a later date, e.g. when a system is emptied.

Safe handling of the material

Before using Peco EGC material, please read the appropriate current Material Safety Data Sheet and follow all precautionary instructions provided therein.
Before using the material, please make sure that it is suitable for the intended purpose.

Packaging units and storage

name	Contents	Crowd
Peco EGC 1kg 100433	Ready to use solution 4%	1kg in aluminium safety bottle
Peco EGC 7kg 100434	Ready to use solution 4%	7kg in aluminium safety bottle
Peco EGC 15kg 100434	Ready to use solution 4%	15kg in aluminium safety bottle
Peco EGC Concentrate 1kg 100430	Concentrate for re-dosing 20%	1kg in aluminium safety bottle
Peco EGC Solvent 7kg 100437	Solvent for dilution	7kg in aluminium safety bottle
Peco EGC Solvent 15kg 100438	Solvent for dilution	15kg in aluminium safety bottle

The containers are resealable.
The storage room should be ventilated.
There is no time limit on the storage life of the material.
Avoid heating above 54°C (boiling point).

Shelf life of the container: 5 years

If you have any questions about the material and its processing, please contact:
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