



Thin Film Measurement solution
Software, sensors, custom development
and integration

Measurement of Silicon Layer Thickness inside Syringe Cartridges

Prefillable glass syringe cartridges are washed, siliconized, sterilized and packaged by the manufacturer. Siliconization of the syringe barrels is very important- it serves as a lubricant and enables plunger to glide smoothly. It also provides hydrophobic layer that prevents interactions of drugs with glass surface. Both inadequate and excessive siliconization can cause problems. Most of siliconization in the modern production is using “Baked-on” process where silicon emulsion is sprayed and after that baked to create a permanent layer. Production control of the thickness and uniformity of the silicon layer is essential element of the product quality control.

MProbe Vis-MSP (400-1000nm wavelength range, 10nm to 50 μm thickness range) offer non-destructive measurement solution to determine thickness of the silicon layer. Measurements can be easily done on selected products from the batch. Inline measurement requires additional holder and automation to rotate and move syringe for mapping the film thickness distribution. High-power Xe flash light source is used in inline system, in addition to TH lamp option, to achieve fast measurement.

Measurement is done with a small spot (20 μm to 40 μm) because of the high curvature of the barrel.

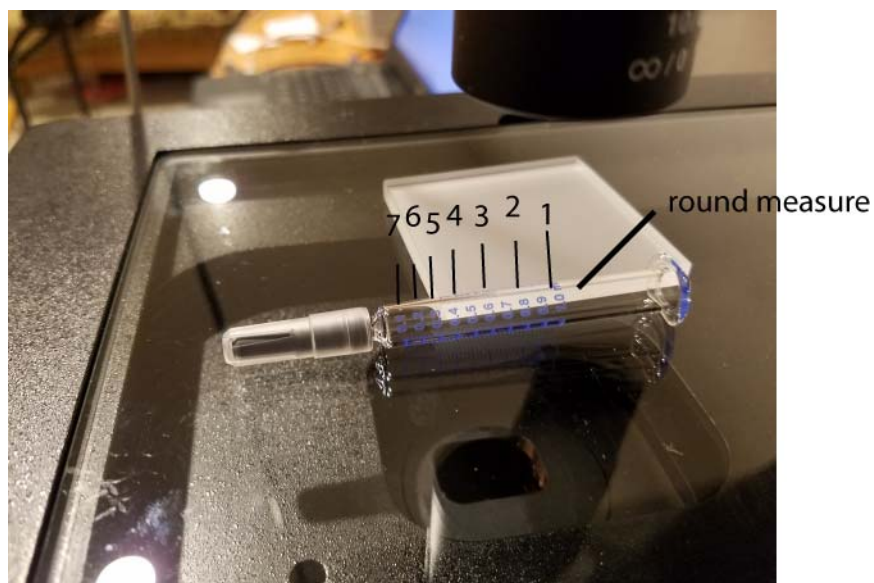


Fig. 1 Syringe cartridge is placed on the MProbeVis-MSP table.
Locations of the measurement points are indicated
 (“Round measure” is point where measurement were taken as syringe was rotated)

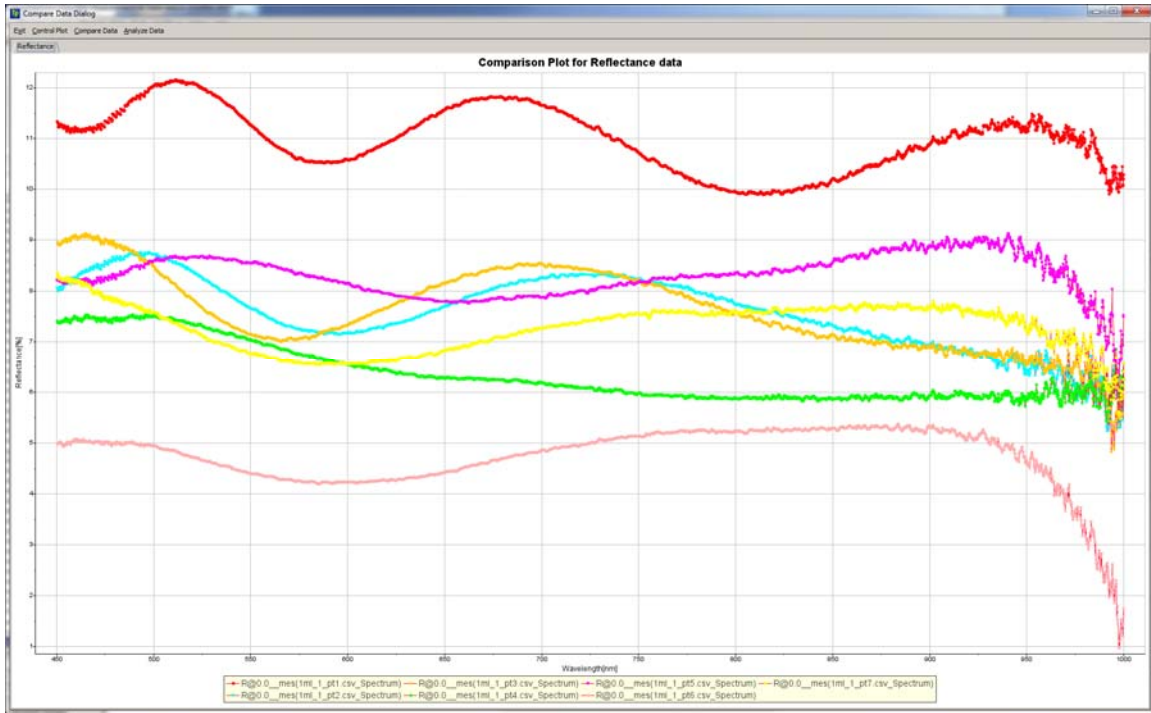


Fig. 2 Measured reflectance spectra in 7 different points along the 1ml syringe barrel.

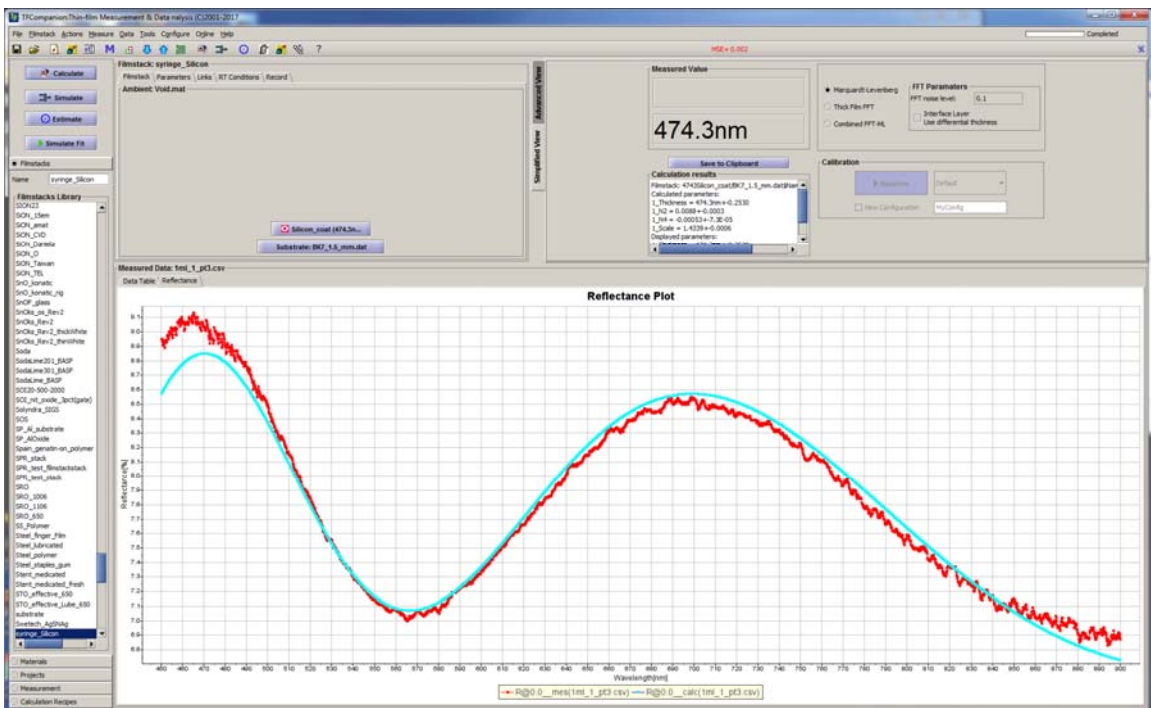


Fig. 2. Example of the measurement result The thickness is determined by fitting a model of siliconized layer to measured data.

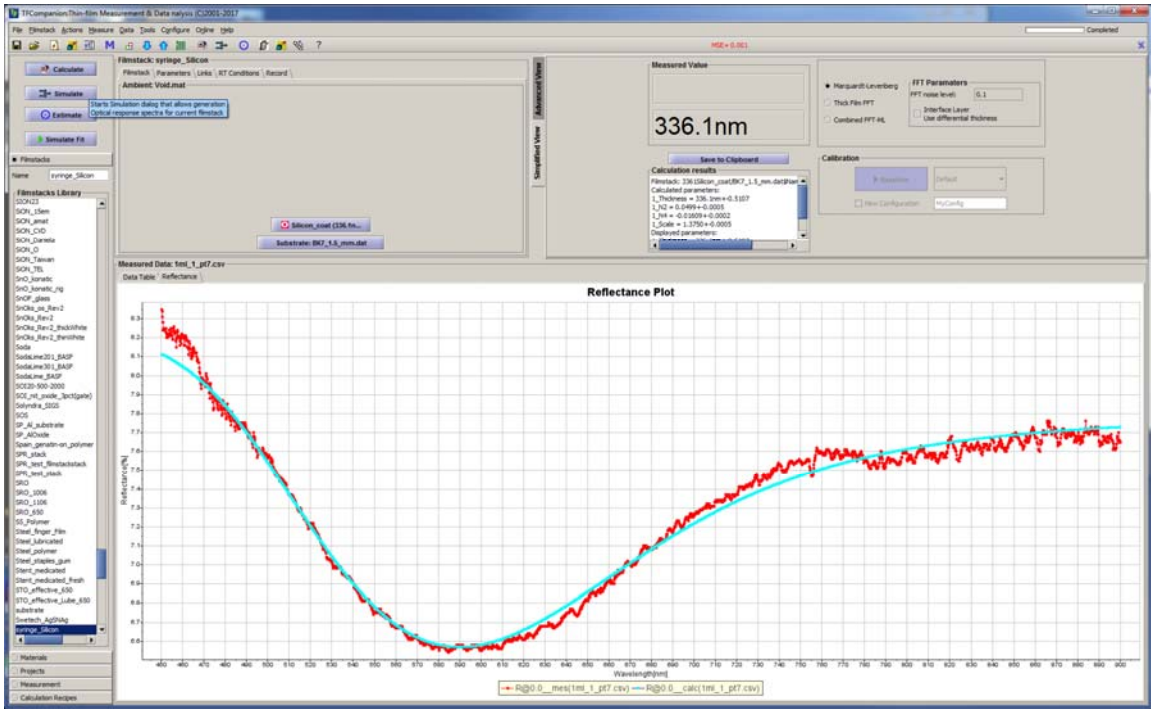


Fig. 3 Example of the measurement result (thin layer). The thickness is determined by fitting a model of siliconized layer to measured data

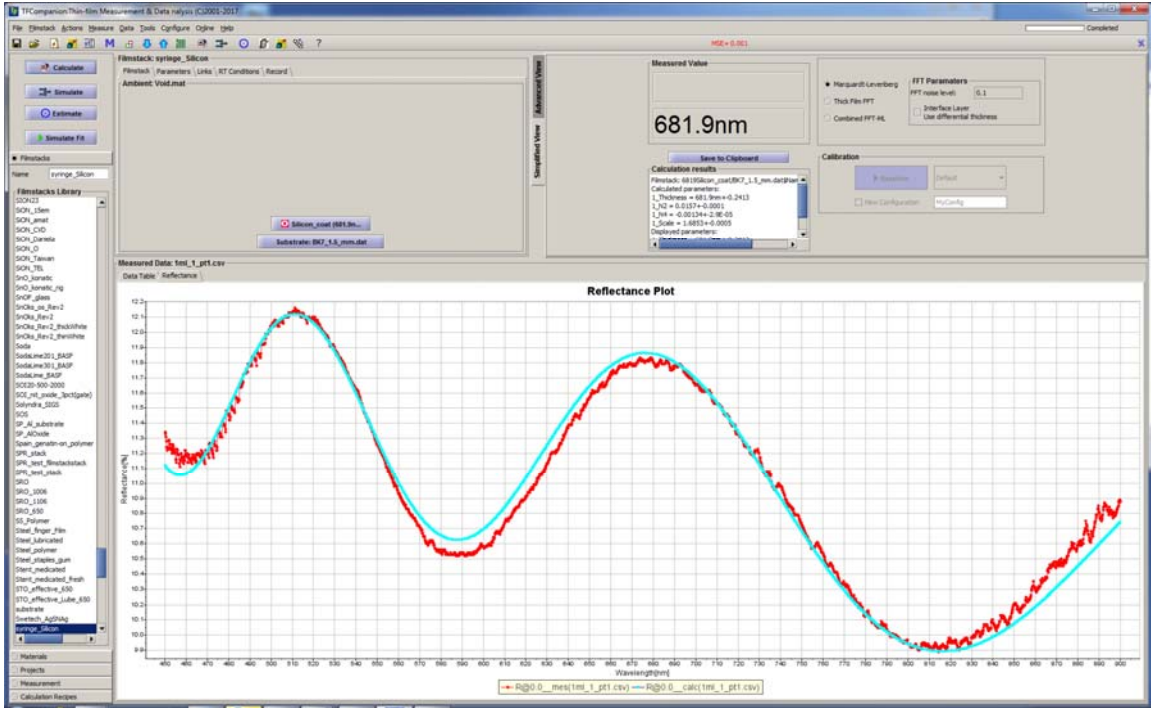


Fig. 4 Example of the measurement result (thick layer). The thickness is determined by fitting a model of siliconized layer to measured data

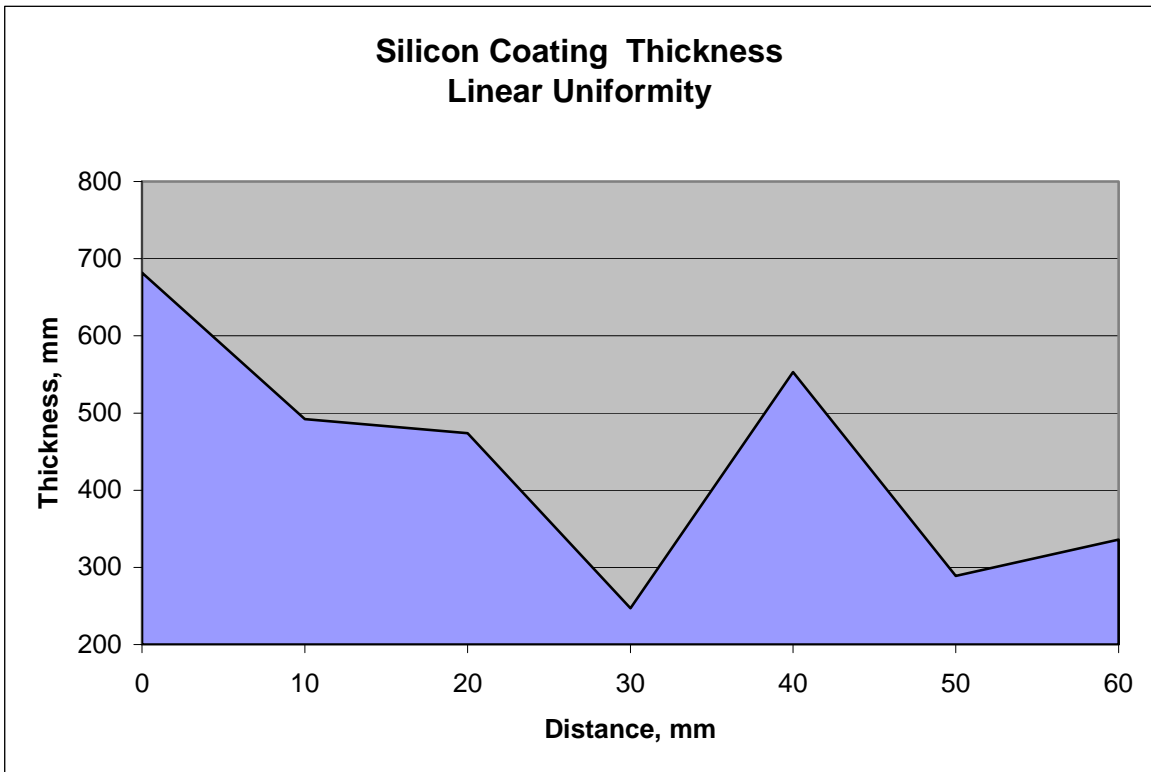


Fig. 5. Measured siliconized layer thickness distribution along the syringe barrel

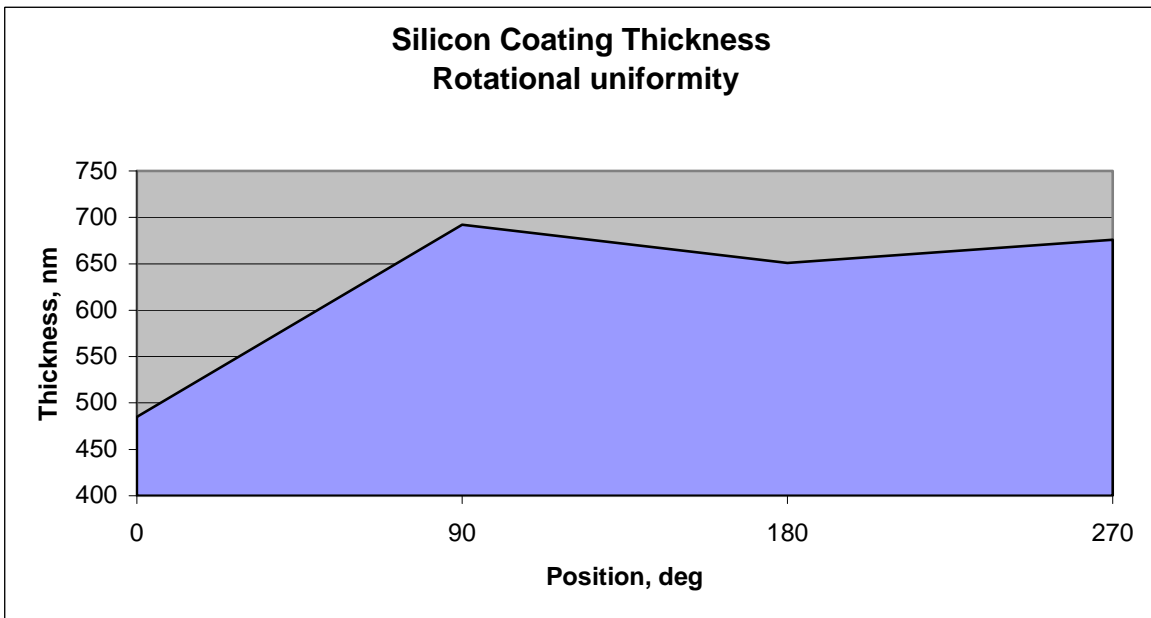


Fig. 6. Measured siliconized layer thickness distribution – measured rotating syringe

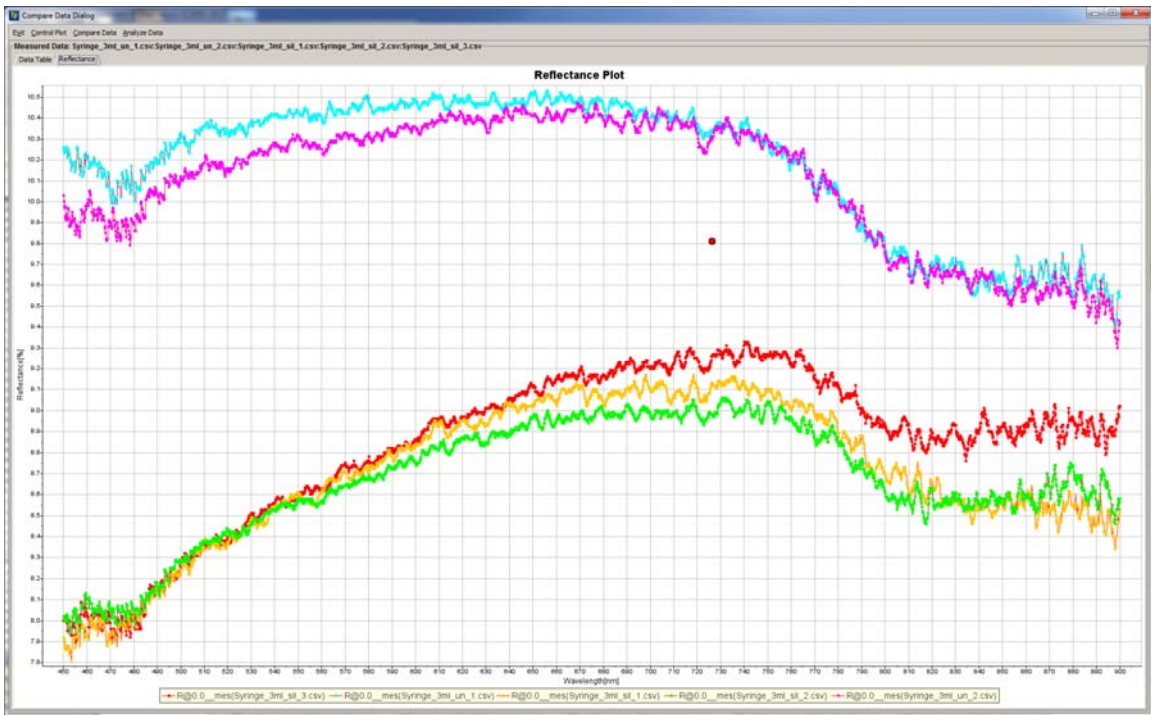


Fig. 7. Measured reflectance spectra of uncoated (top two) and coated/siliconized (bottom three) 3ml syringe barrels. Coating is ~ 150nm

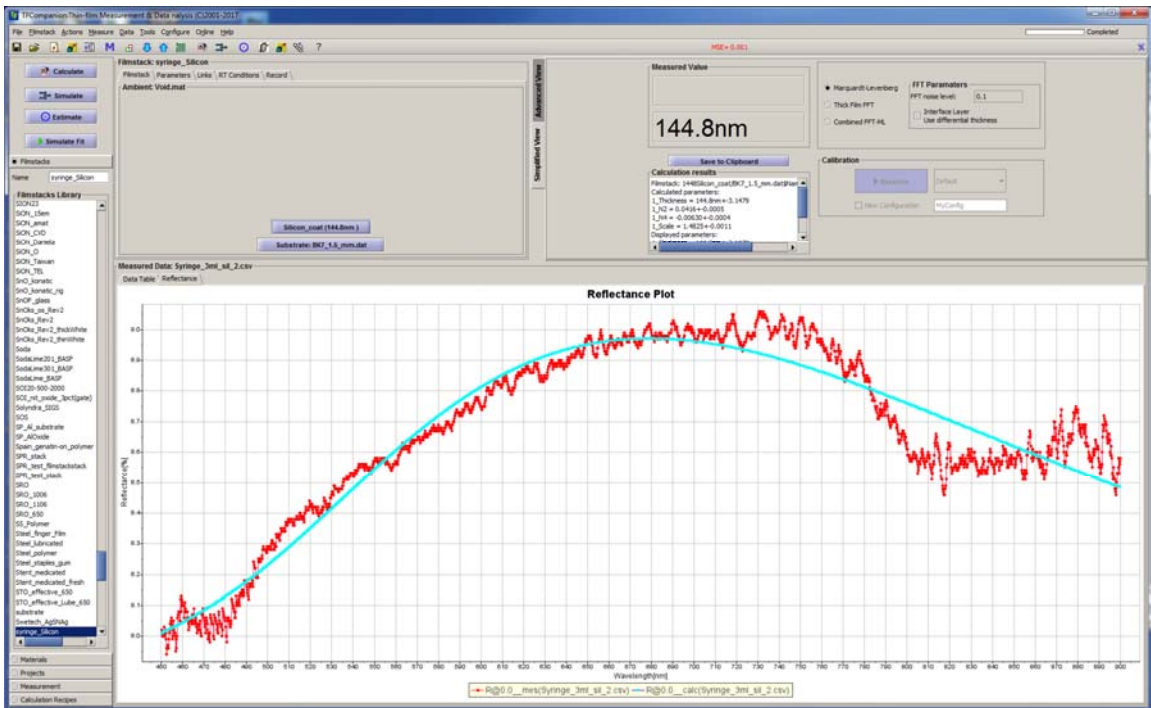


Fig. 8 Measured thickness of siliconized layer on 3ml syringe barrel. Fit of the model to measured data.

Siliconized Vials

Similar to syringes, glass vials are siliconized inside to prevent reaction of the medication with dopants/contaminants in the glass. The thickness of this coating is typically thinner than in syringes.

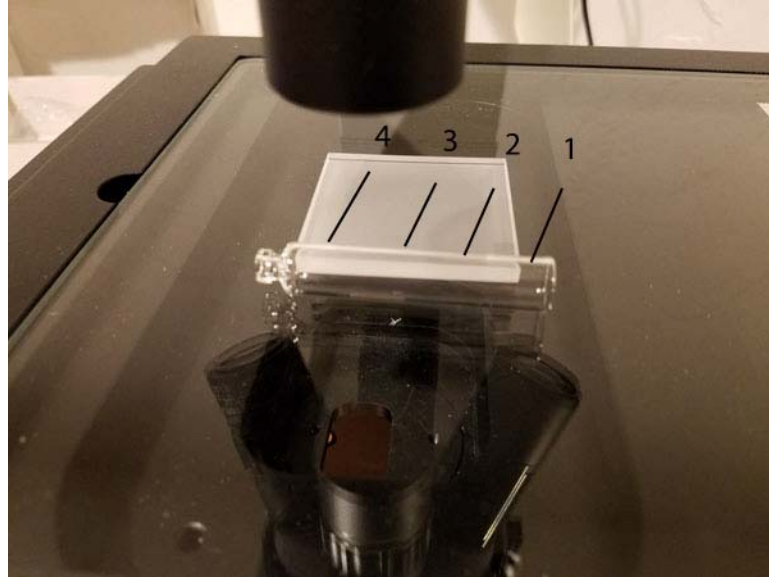


Fig. 9 Vial with the measured points marked.

Point	Thickness ,nm
1	59 nm
2	59 nm
3	55 nm
4	44 nm

Table. Results of measurement (the thickness of siliconized layer inside the vial)

Measurements are done using 40 μ m spot size.

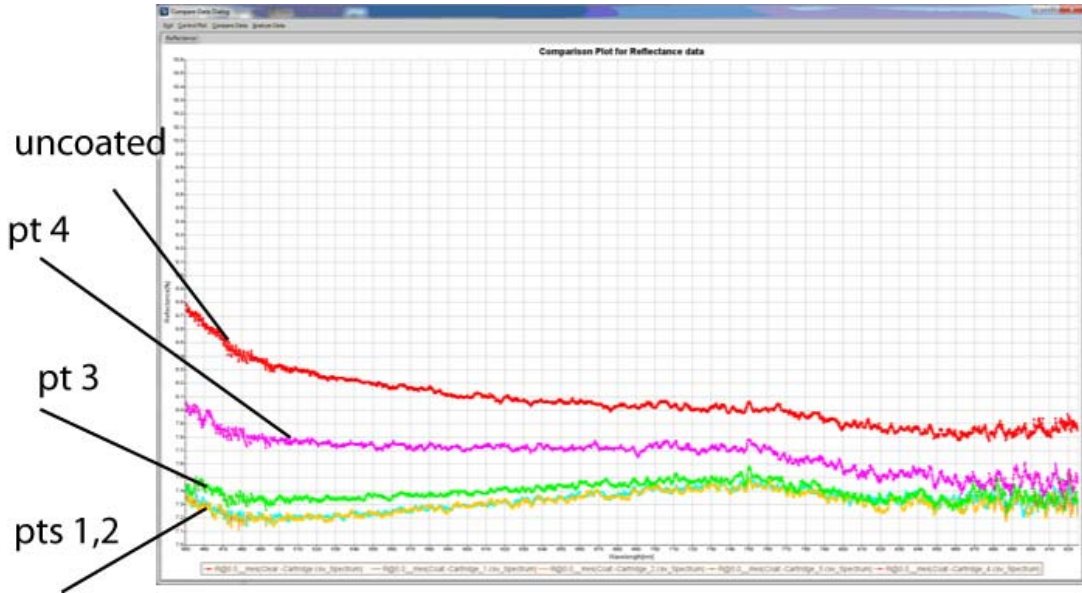


Fig. 10. Raw reflectance spectra of the measured points (compared with uncoated vial)

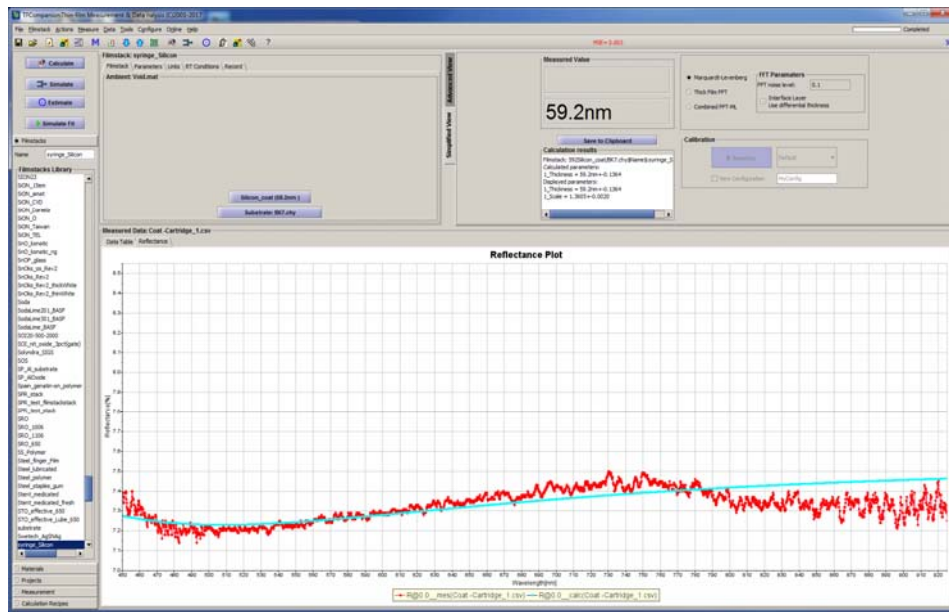


Fig. 11. Results of the measurement example. (Fit of the model to measured data).