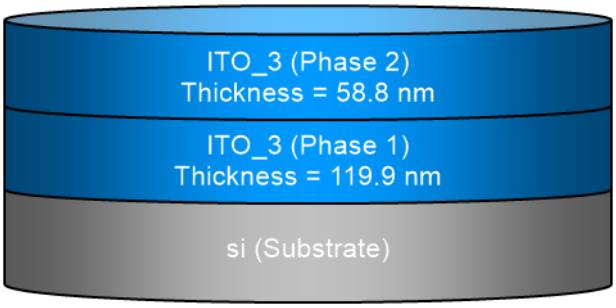
SEA regression report summary

Sample ID
001e-int-i 70° 1
001e-int-i 65° 2
001e-int-i 60° 3

Details	
Software and regression log	
Software about	Semilab - Spectroscopic Ellipsometry Analyzer - SEA
Software version	1.7.1
Officially licensed to	MIT
Operator	operator
Date and time of regression	01-04-2022 14:24
Comments	

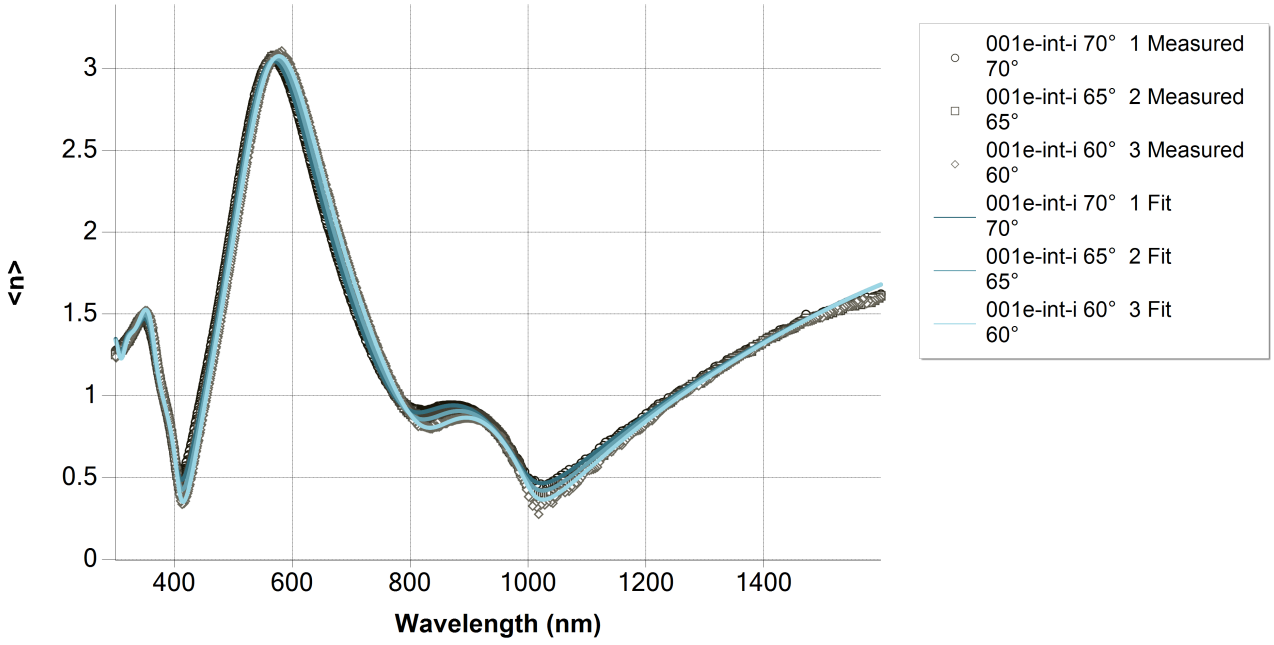
Layer structure	
Overview	
	
Optical model	
Phase 2	ITO_3
Dispersion law	Lorentz
	Drude
	Lorentz
Phase 1	ITO_3
Dispersion law	Lorentz
	Drude
	Lorentz

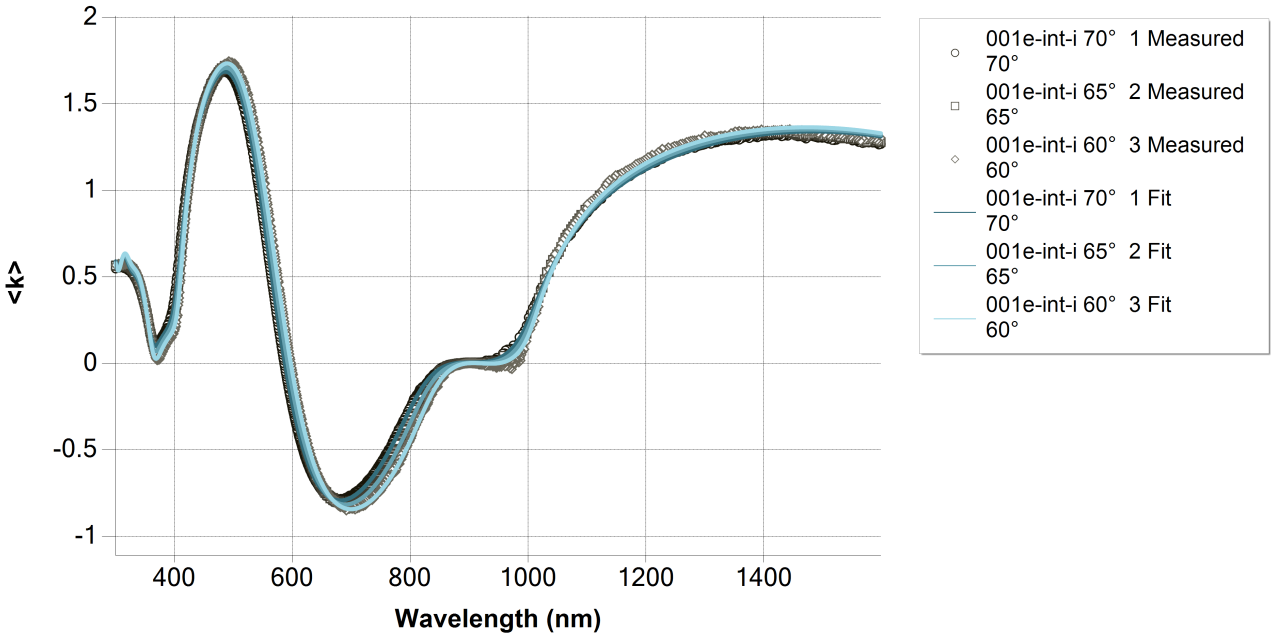
Regression results

Measurement information				
Measurement 1				
Measurement file path	C:\Users\emmabat\ito-si\001e-int-i.smdx			
Angle of Incidence	70°			
Measurement 2				
Measurement file path	C:\Users\emmabat\ito-si\001e-int-i.smdx			
Angle of Incidence	65°			
Measurement 3				
Measurement file path	C:\Users\emmabat\ito-si\001e-int-i.smdx			
Angle of Incidence	60°			
Regression details				
Regression 1 (EllipsoReflectance)				
Wavelength range	300.14 - 1599.16 nm			
Angle of Incidence	70°			
Fit to	<n>, <k>			
Regression 2 (EllipsoReflectance)				
Wavelength range	300.14 - 1599.16 nm			
Angle of Incidence	65°			
Fit to	<n>, <k>			
Regression 3 (EllipsoReflectance)				
Wavelength range	300.14 - 1599.16 nm			
Angle of Incidence	60°			
Fit to	<n>, <k>			
Angular Aperture	0°			
Fit algorithm	LMA			
Results				
Parameters	Value	Fitted	2 σ confidence limit	Unit
Model				
AOI Shift	0			°
Angular Aperture	0			°
Phase 2 (ITO_3)				
Thickness	58.844	X	0.071381	nm
f	0.26297	X	0.0050088	
E0 (eV)	3.35694	X	0.0080301	eV
Γ (eV)	1.22101	X	0.010767	eV
E_p (eV)	0.66749	X	0.0047342	eV
E_Γ (eV)	0.45029	X	0.0085326	eV
f	0.24843	X	0.0089994	
E0 (eV)	4.28821	X	0.0085826	eV
Γ (eV)	0.54174	X	0.021437	eV
Eps_inf	1.41826	X	0.01136	
Phase 1 (ITO_3)				
Thickness	119.864	X	0.096787	nm
f	0.16357			
E0 (eV)	3.74618			eV

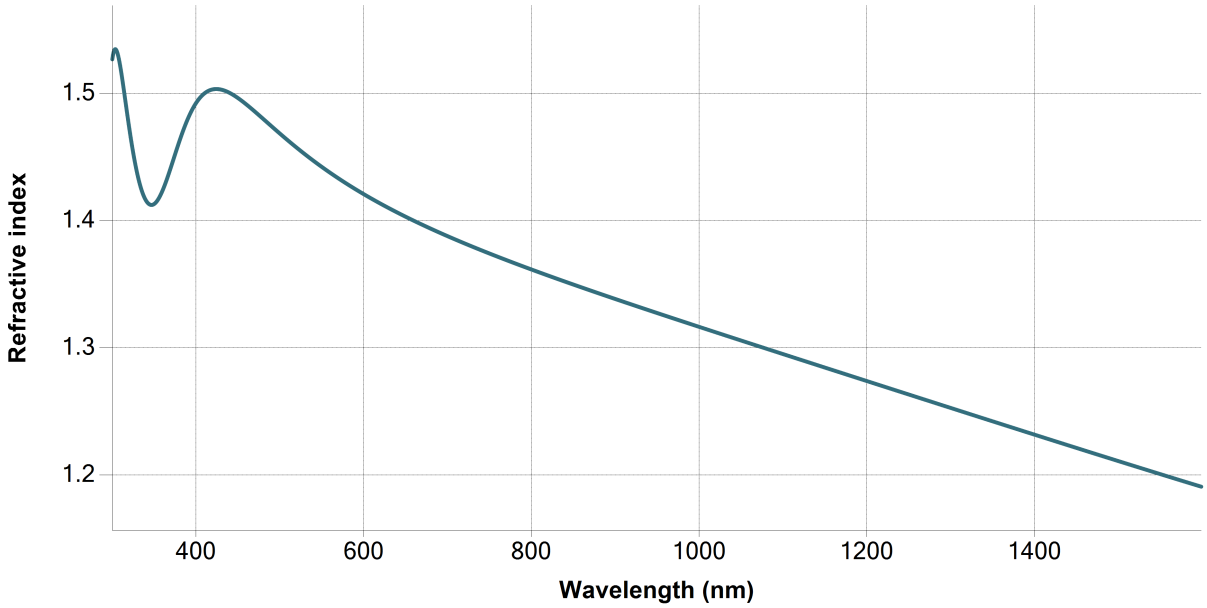
Γ (eV)	0.62015			eV
E_p (eV)	1.09856			eV
E_Γ (eV)	0.22823			eV
f	0.43808			
E0 (eV)	4.29829			eV
Γ (eV)	0.24163			eV
Eps_inf	3.4998			
Derived parameters	Value			
Phase 2 (ITO_3)				
n @ 632.8 nm	1.4089			
k @ 632.8 nm	0.0584			
Phase 1 (ITO_3)				
n @ 632.8 nm	1.9911			
k @ 632.8 nm	0.0202			
Substrate (si)				
n @ 632.8 nm	3.8811			
k @ 632.8 nm	0.0195			
Drude derived parameters	Value			Unit
Phase 2 (ITO_3)				
Conductivity (S/m)	1.331E+04 ± 441.0167			S/m
Resistivity (mΩ.cm)	7.5131 ± 0.2489			mΩ.cm
Resistance (Ω/sq)	1276.79 ± 43.854			Ω/sq
N type dopant concentration (at/cm3)	8.0782E+19 ± 1.1459E+18			at/cm3
P type dopant concentration (at/cm3)	1.1956E+20 ± 1.6959E+18			at/cm3
N type dopant mobility (cm2/Vs)	10.2838 ± 0.3707			cm2/Vs
P type dopant mobility (cm2/Vs)	6.9485 ± 0.2504			cm2/Vs
Phase 1 (ITO_3)				
Conductivity (S/m)	7.1131E+04 ± 0			S/m
Resistivity (mΩ.cm)	1.4058 ± 0			mΩ.cm
Resistance (Ω/sq)	117.2869 ± 0.0947			Ω/sq
N type dopant concentration (at/cm3)	2.1881E+20 ± 0			at/cm3
P type dopant concentration (at/cm3)	3.2384E+20 ± 0			at/cm3
N type dopant mobility (cm2/Vs)	20.2898 ± 0			cm2/Vs
P type dopant mobility (cm2/Vs)	13.7093 ± 0			cm2/Vs
Fit quality				
R^2	0.99933			
RMSE	0.01955			

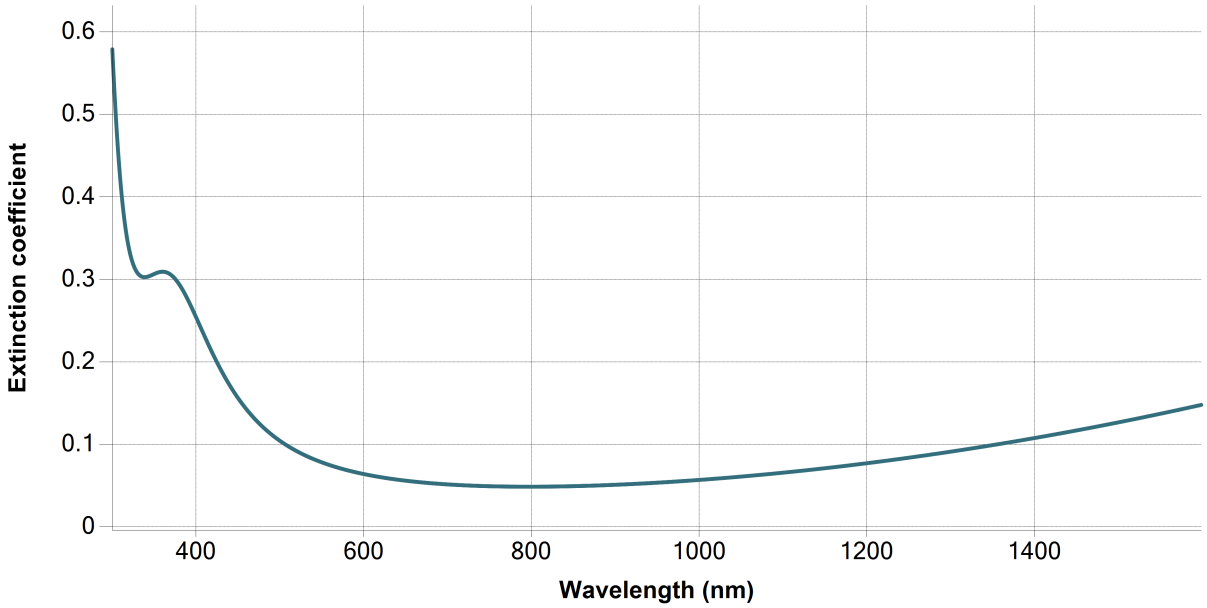
Regression graphs



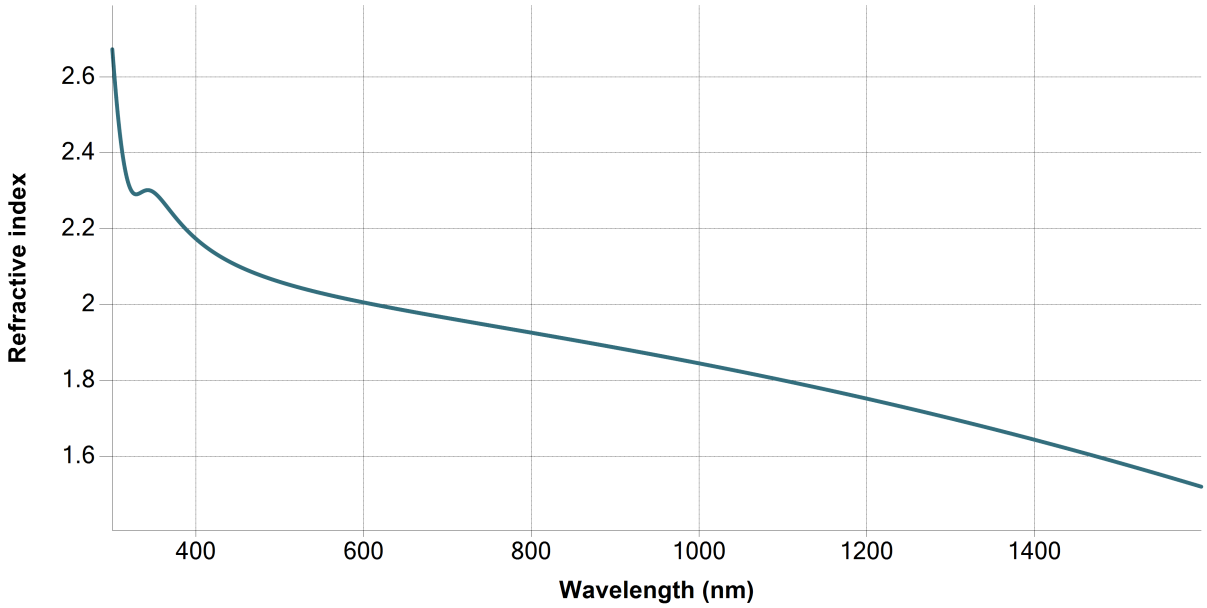


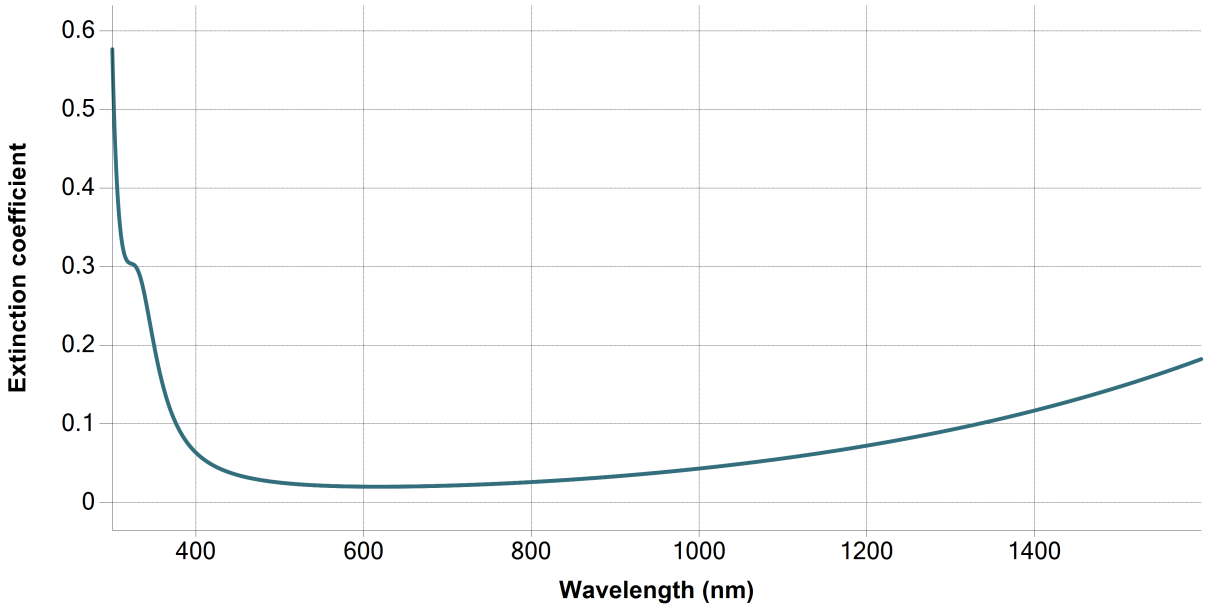
Phase 2 (ITO_3) - Dispersion graphs



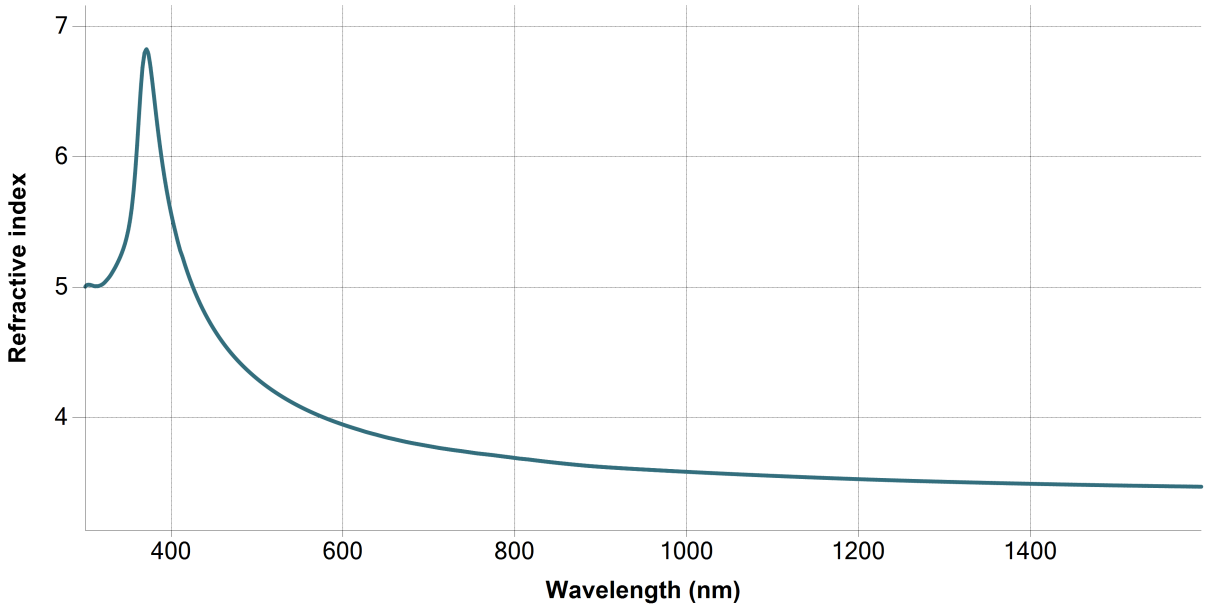


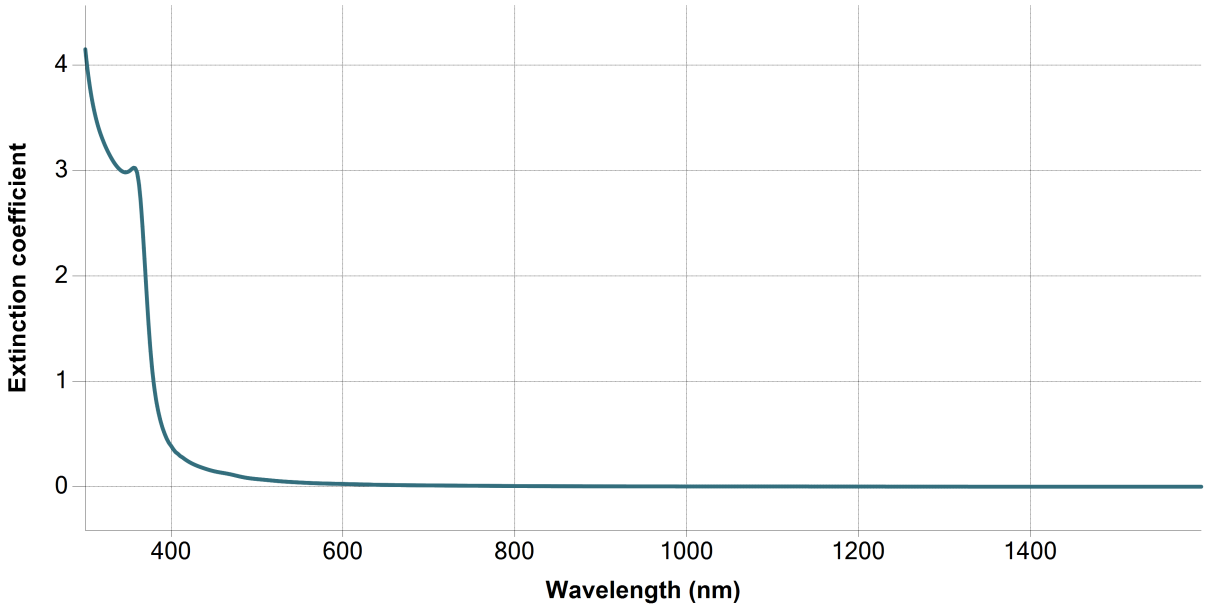
Phase 1 (ITO_3) - Dispersion graphs





Substrate (si) - Dispersion graphs





Correlation coefficients	
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[1] - f	-0.0451
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[1] - E0 (eV)	-0.0387
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[1] - Γ (eV)	-0.0079
Ph2 - ITO_3 - Thickness --- Ph2 - Drude[2] - E_p (eV)	-0.2434
Ph2 - ITO_3 - Thickness --- Ph2 - Drude[2] - E_Γ (eV)	0.1404
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[3] - f	0.0004
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[3] - E0 (eV)	-0.0763
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[3] - Γ (eV)	0.0533
Ph2 - ITO_3 - Thickness --- Ph2 - Eps_inf	-0.1017
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[1] - E0 (eV)	0.9528
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[1] - Γ (eV)	0.8187
Ph2 - Lorentz[1] - f --- Ph2 - Drude[2] - E_p (eV)	0.5056
Ph2 - Lorentz[1] - f --- Ph2 - Drude[2] - E_Γ (eV)	-0.4072
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[3] - f	-0.9015
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[3] - E0 (eV)	-0.6917
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[3] - Γ (eV)	-0.8965
Ph2 - Lorentz[1] - f --- Ph2 - Eps_inf	0.6999
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[1] - Γ (eV)	0.8497
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Drude[2] - E_p (eV)	0.4255
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Drude[2] - E_Γ (eV)	-0.3751
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[3] - f	-0.8243
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[3] - E0 (eV)	-0.5868
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[3] - Γ (eV)	-0.801
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Eps_inf	0.6068
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Drude[2] - E_p (eV)	0.3294
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Drude[2] - E_Γ (eV)	-0.4805
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Lorentz[3] - f	-0.6055
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Lorentz[3] - E0 (eV)	-0.4085
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Lorentz[3] - Γ (eV)	-0.5992
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Eps_inf	0.4259
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Drude[2] - E_Γ (eV)	-0.2463
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Lorentz[3] - f	-0.6149
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Lorentz[3] - E0 (eV)	-0.5055
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Lorentz[3] - Γ (eV)	-0.4613
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Eps_inf	0.842
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Lorentz[3] - f	0.3195
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Lorentz[3] - E0 (eV)	0.2073
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Lorentz[3] - Γ (eV)	0.2635
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Eps_inf	-0.3357
Ph2 - Lorentz[3] - f --- Ph2 - Lorentz[3] - E0 (eV)	0.8789
Ph2 - Lorentz[3] - f --- Ph2 - Lorentz[3] - Γ (eV)	0.9206
Ph2 - Lorentz[3] - f --- Ph2 - Eps_inf	-0.8578
Ph2 - Lorentz[3] - E0 (eV) --- Ph2 - Lorentz[3] - Γ (eV)	0.8133
Ph2 - Lorentz[3] - E0 (eV) --- Ph2 - Eps_inf	-0.7535
Ph2 - Lorentz[3] - Γ (eV) --- Ph2 - Eps_inf	-0.6773