SEA regression report summary

Sample ID
001d-int-ii 70° 1
001d-int-ii 65° 2
001d-int-ii 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 14:23
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\001d-int-ii.smdx
Angle of Incidence	70°
Measurement 2	
Measurement file path	C:\Users\emmabat\ito-si\001d-int-ii.smdx
Angle of Incidence	65°
Measurement 3	
Measurement file path	C:\Users\emmabat\ito-si\001d-int-ii.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	49.626	X	0.087421	nm
f	0.26705	X	0.003797	
E0 (eV)	3.24269	X	0.0082902	eV
Γ (eV)	1.35624	X	0.017352	eV
E_p (eV)	0.84269	X	0.0051582	eV
E_Γ (eV)	0.42633	X	0.0092132	eV
f	0.2173	X	0.0057519	
E0 (eV)	4.21837	X	0.0045793	eV
Γ (eV)	0.31803	X	0.0091964	eV
Eps_inf	1.8035	X	0.010581	
Phase 1 (ITO_3)				
Thickness	120.056	X	0.1026	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	1.5069			
k @ 632.8 nm	0.0648			
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)	2.2407E+04 ± 758.5276			S/m
Resistivity (mΩ.cm)	4.4629 ± 0.1511			mΩ.cm
Resistance (Ω/sq)	899.3111 ± 32.0283			Ω/sq
N type dopant concentration (at/cm3)	1.2876E+20 ± 1.5762E+18			at/cm3
P type dopant concentration (at/cm3)	1.9056E+20 ± 2.3328E+18			at/cm3
N type dopant mobility (cm2/Vs)	10.8618 ± 0.391			cm2/Vs
P type dopant mobility (cm2/Vs)	7.3391 ± 0.2642			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)	117.099 ± 0.1001			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	0.99903			
RMSE	0.02465			

Regression graphs

![SEMILAB]
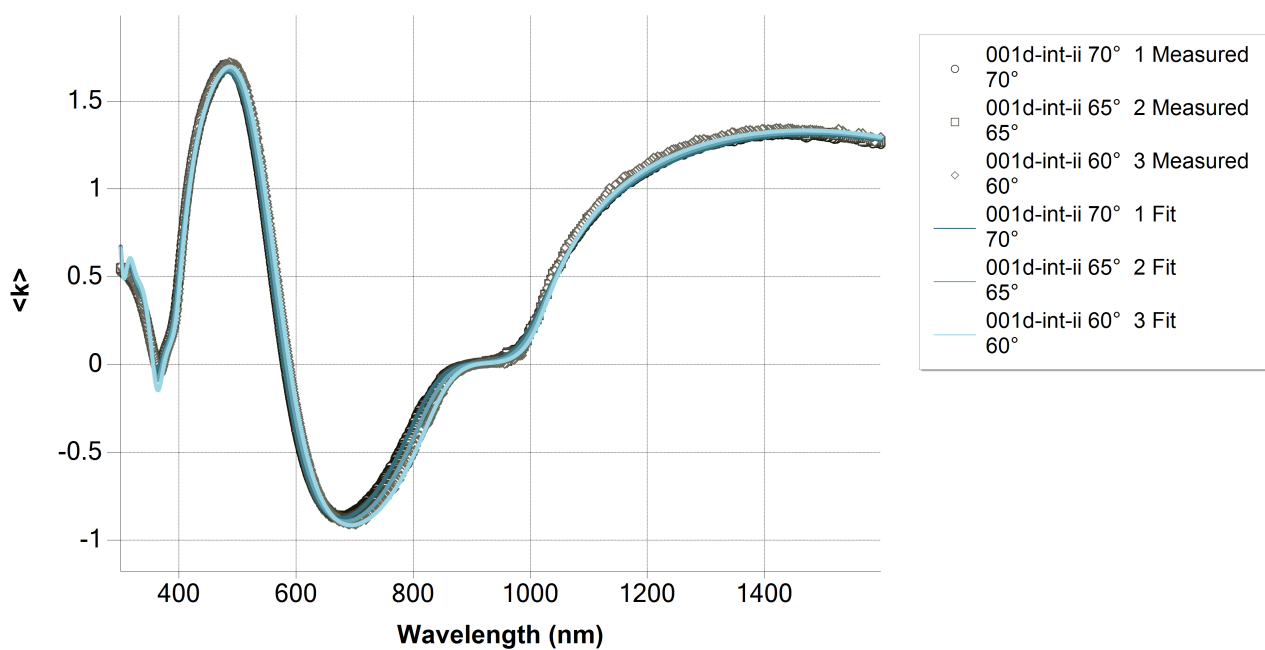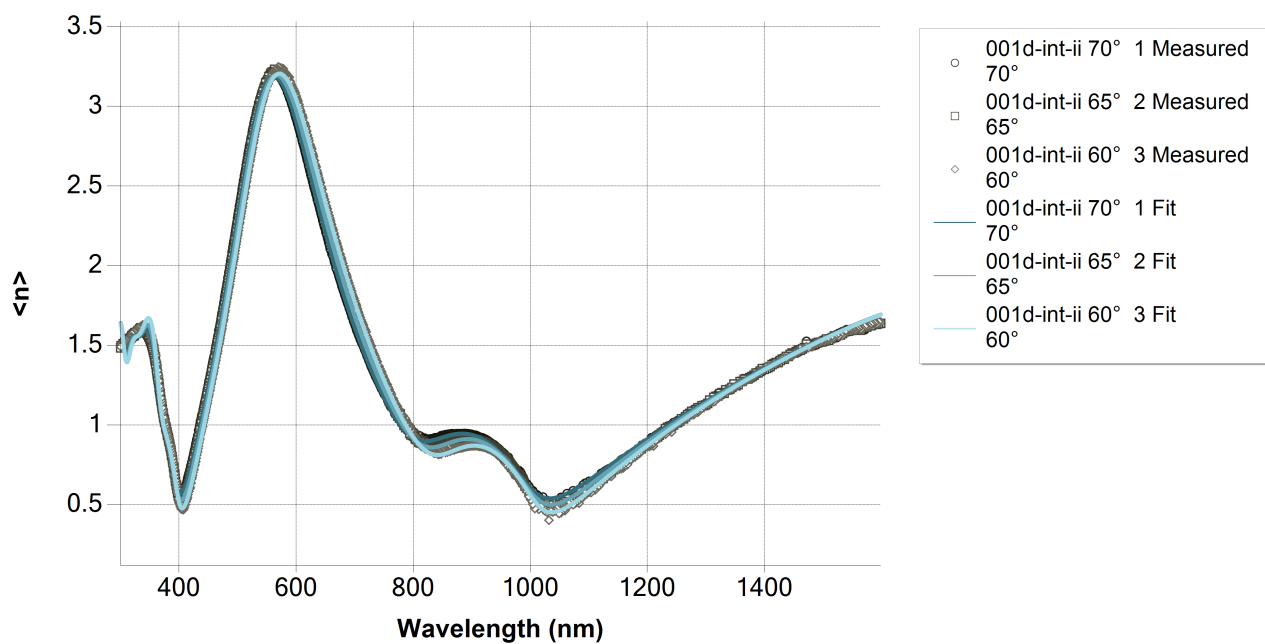
Phase 2 (ITO_3) - Dispersion graphs
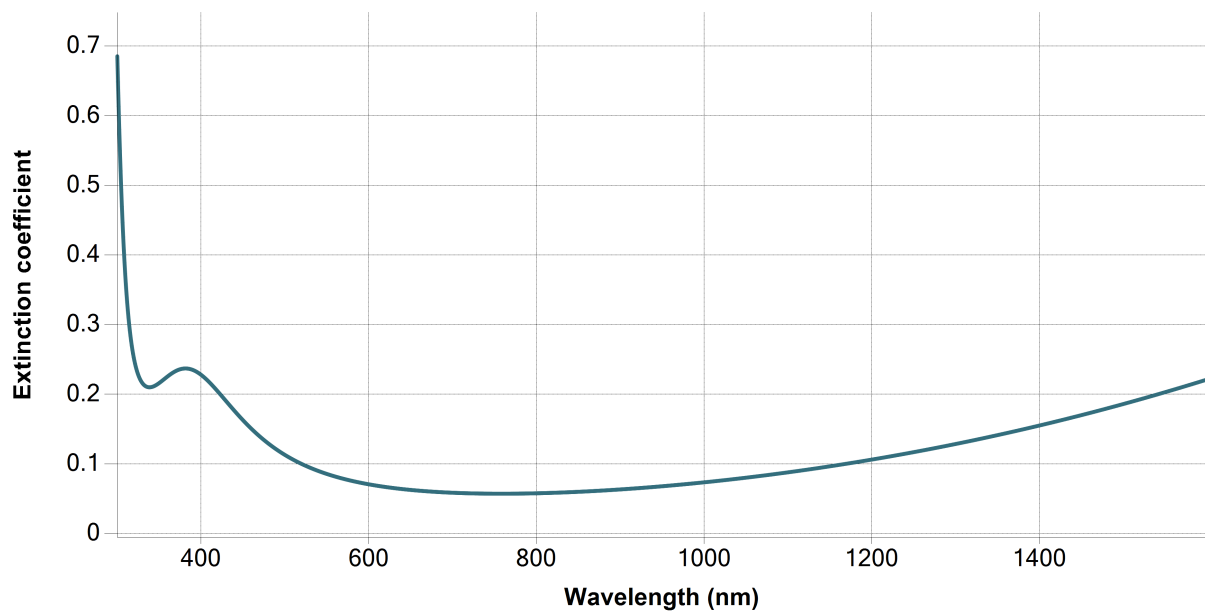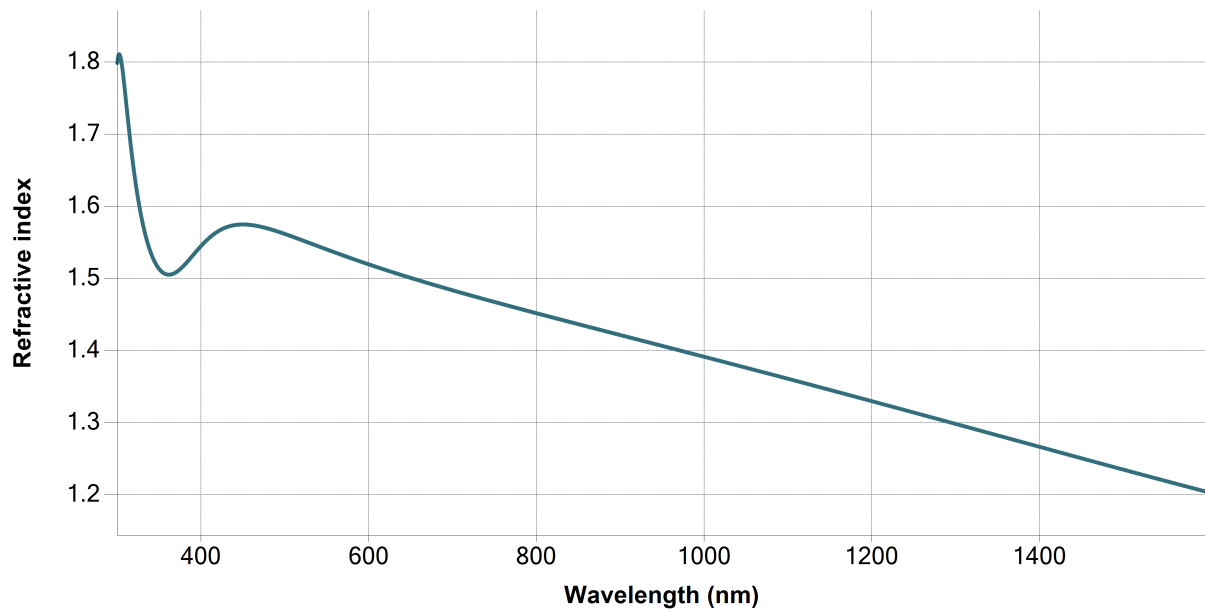
Phase 1 (ITO_3) - Dispersion graphs
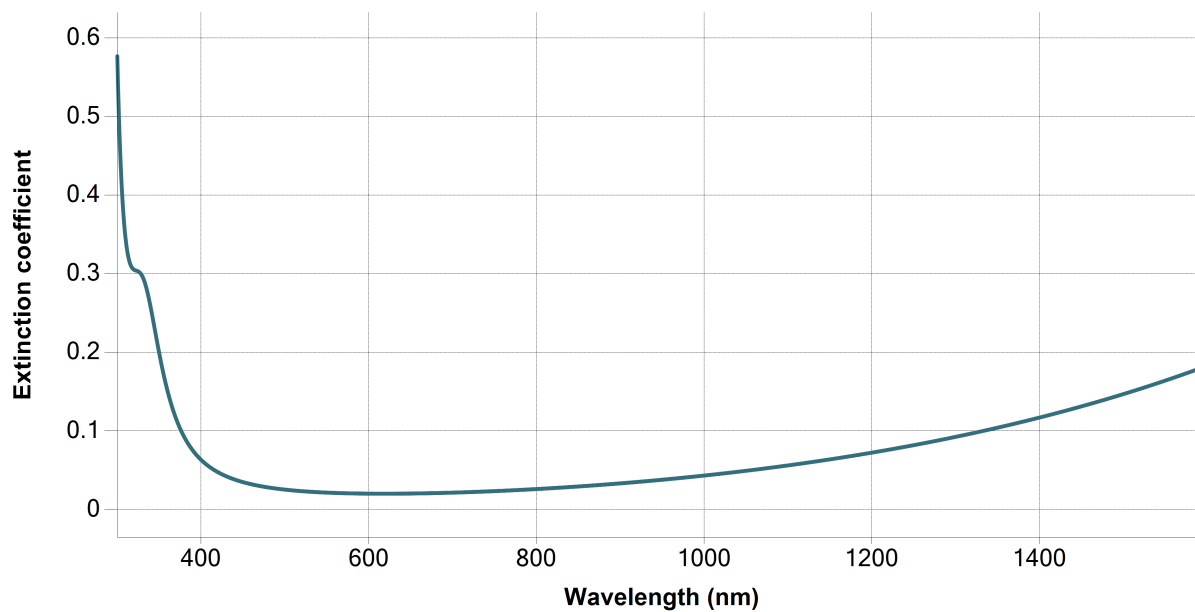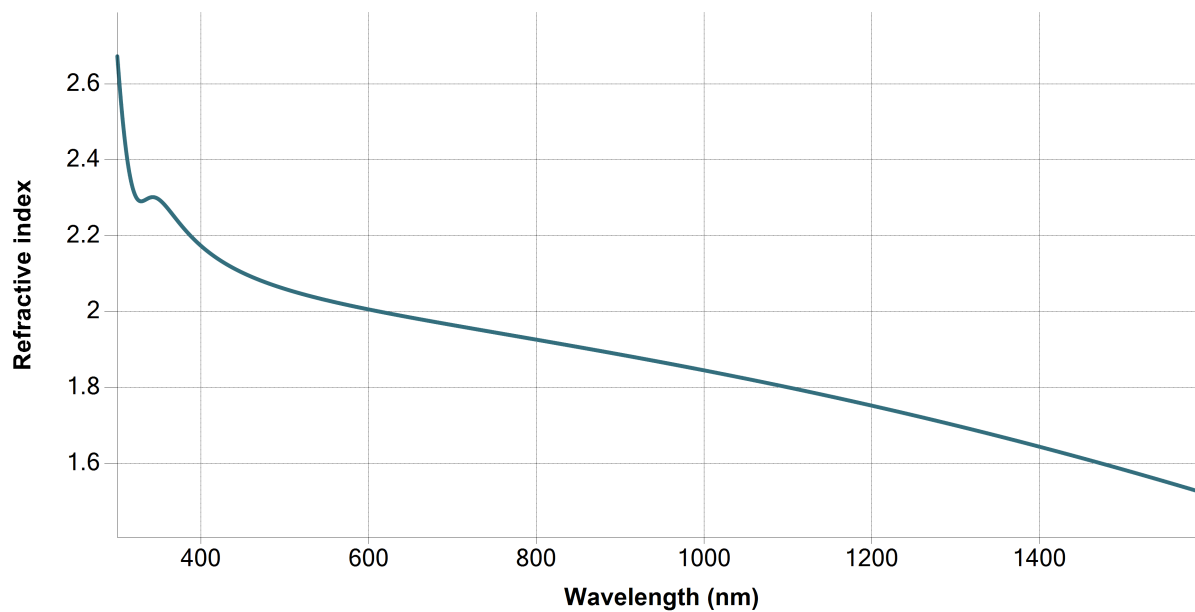
Substrate (si) - Dispersion graphs
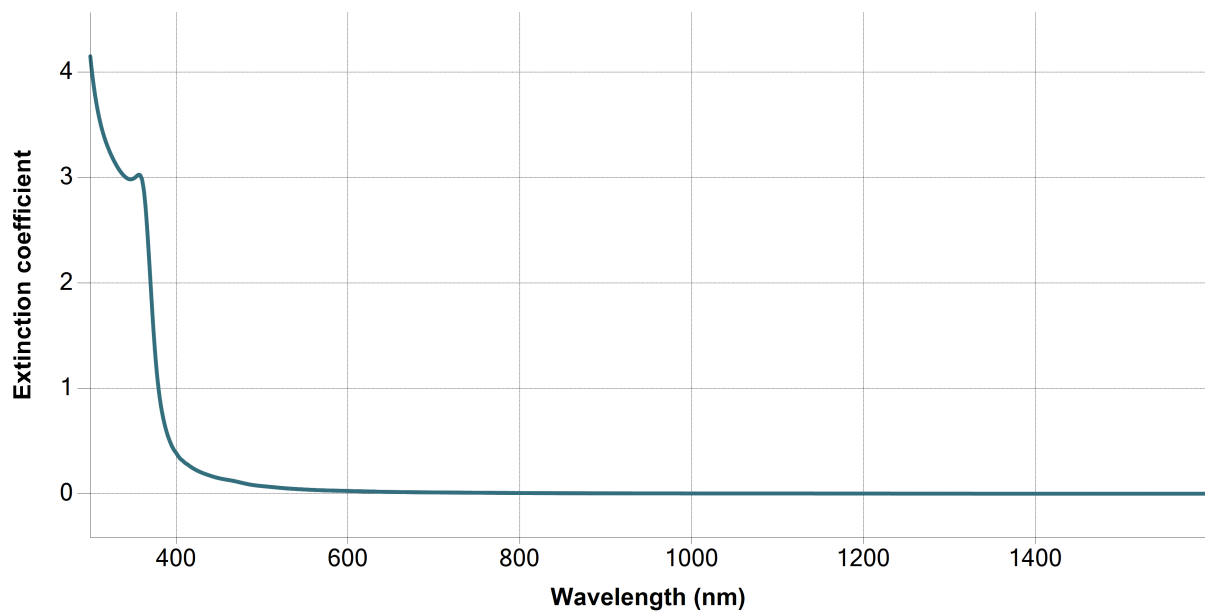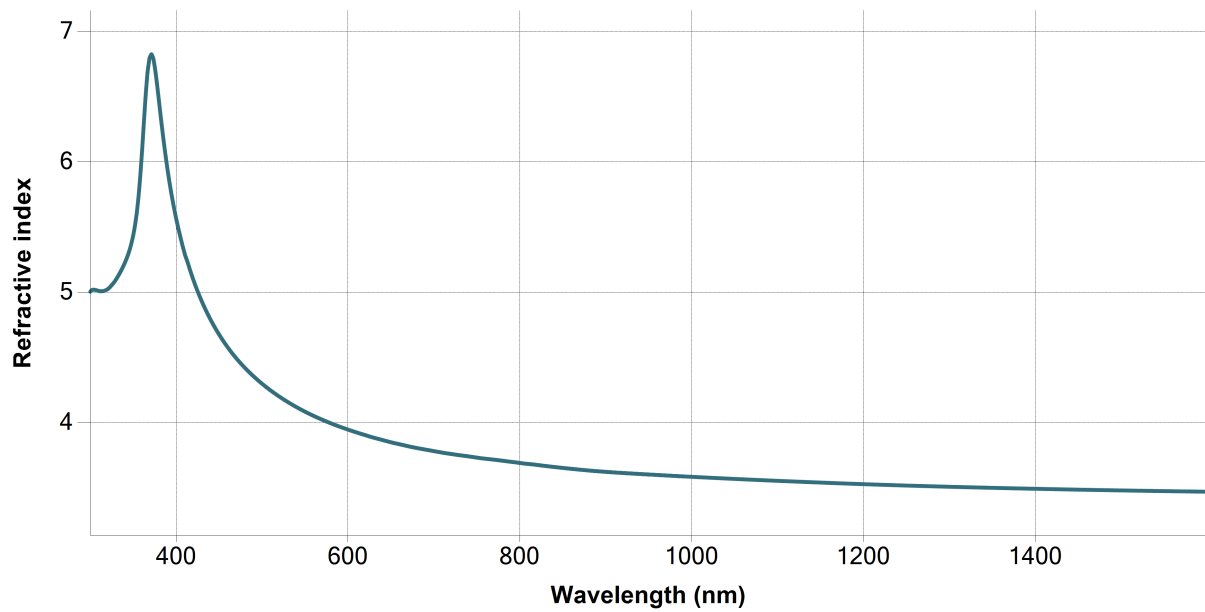
Correlation coefficients	
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[1] - f	0.1348
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[1] - E0 (eV)	0.1253
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[1] - Γ (eV)	0.082
Ph2 - ITO_3 - Thickness --- Ph2 - Drude[2] - E_p (eV)	-0.1102
Ph2 - ITO_3 - Thickness --- Ph2 - Drude[2] - E_Γ (eV)	0.015
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[3] - f	-0.0303
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[3] - E0 (eV)	-0.0506
Ph2 - ITO_3 - Thickness --- Ph2 - Lorentz[3] - Γ (eV)	0.1075
Ph2 - ITO_3 - Thickness --- Ph2 - Eps_inf	0.069
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[1] - E0 (eV)	0.8655
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[1] - Γ (eV)	0.8907
Ph2 - Lorentz[1] - f --- Ph2 - Drude[2] - E_p (eV)	0.3187
Ph2 - Lorentz[1] - f --- Ph2 - Drude[2] - E_Γ (eV)	-0.4942
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[3] - f	-0.6525
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[3] - E0 (eV)	-0.4459
Ph2 - Lorentz[1] - f --- Ph2 - Lorentz[3] - Γ (eV)	-0.6315
Ph2 - Lorentz[1] - f --- Ph2 - Eps_inf	0.4842
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[1] - Γ (eV)	0.8027
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Drude[2] - E_p (eV)	0.2262
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Drude[2] - E_Γ (eV)	-0.3301
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[3] - f	-0.7069
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[3] - E0 (eV)	-0.4923
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Lorentz[3] - Γ (eV)	-0.6678
Ph2 - Lorentz[1] - E0 (eV) --- Ph2 - Eps_inf	0.4516
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Drude[2] - E_p (eV)	0.2216
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Drude[2] - E_Γ (eV)	-0.5001
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Lorentz[3] - f	-0.4936
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Lorentz[3] - E0 (eV)	-0.301
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Lorentz[3] - Γ (eV)	-0.459
Ph2 - Lorentz[1] - Γ (eV) --- Ph2 - Eps_inf	0.3306
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Drude[2] - E_Γ (eV)	-0.1634
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Lorentz[3] - f	-0.5191
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Lorentz[3] - E0 (eV)	-0.4041
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Lorentz[3] - Γ (eV)	-0.3359
Ph2 - Drude[2] - E_p (eV) --- Ph2 - Eps_inf	0.7751
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Lorentz[3] - f	0.2957
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Lorentz[3] - E0 (eV)	0.1922
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Lorentz[3] - Γ (eV)	0.2429
Ph2 - Drude[2] - E_Γ (eV) --- Ph2 - Eps_inf	-0.2849
Ph2 - Lorentz[3] - f --- Ph2 - Lorentz[3] - E0 (eV)	0.8612
Ph2 - Lorentz[3] - f --- Ph2 - Lorentz[3] - Γ (eV)	0.842
Ph2 - Lorentz[3] - f --- Ph2 - Eps_inf	-0.8193
Ph2 - Lorentz[3] - E0 (eV) --- Ph2 - Lorentz[3] - Γ (eV)	0.7426
Ph2 - Lorentz[3] - E0 (eV) --- Ph2 - Eps_inf	-0.6794
Ph2 - Lorentz[3] - Γ (eV) --- Ph2 - Eps_inf	-0.551