Heterostructure samples measurement

ZnO based heterostructures are use for LED applications. Multiple pairs of identical layers is used in heterostructure to amplify the light emission.
MProbe UVVisSr system (200nm -1000nm) was used to measure the thickness of the layers and verify their optical dispersion. Hereostructure had ZnO and Al203 layer pairs repeated 60 times (ZnO/Al2O3) x 60
To determine optical constants of ZnO and Al2O3 two thick sample of these materials were measured.

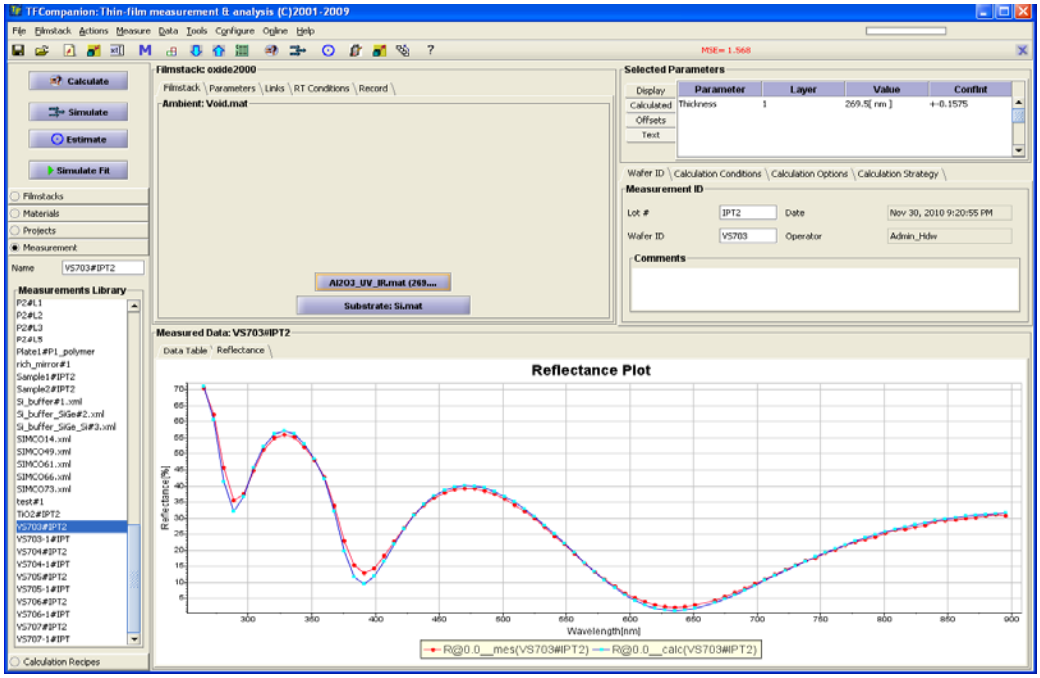

Fig. 1 Measurement of the thick Alumina sample: model to measurement fit. Thickness and optical constants of the Al2O3 were determined. Measured thickness: 269 nm (optical dispersion see Fig. 2)

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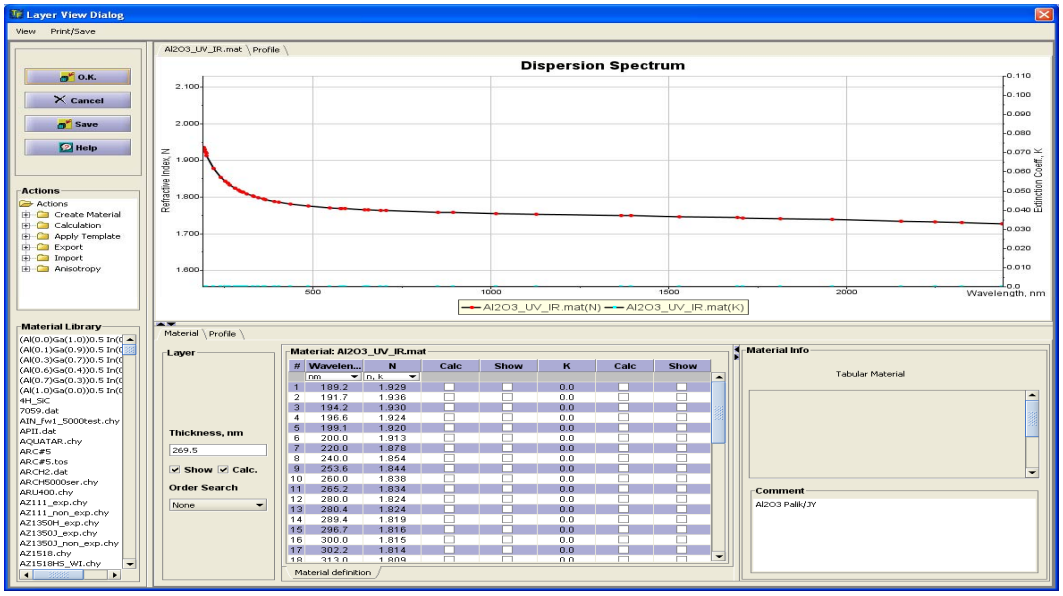
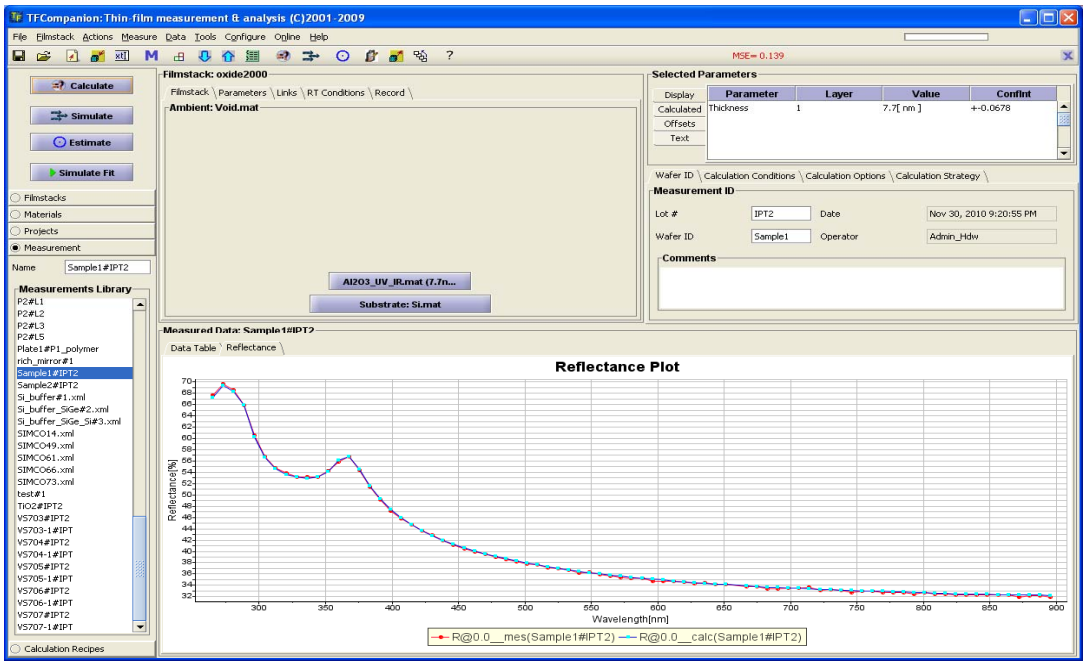


Fig. 2 Optical dispersion of the Al2O3 determined from the measurement. Dispersion is represented using Cauchy approximation.



Fig, 3 Thin Al2O3 sample. Optical dispersion determined from the thick Al2O3 sample was used here to verify the sample properties are valid for a thin film. Thickness was determined 7.7nm. The chart shows fit of the model to measured data

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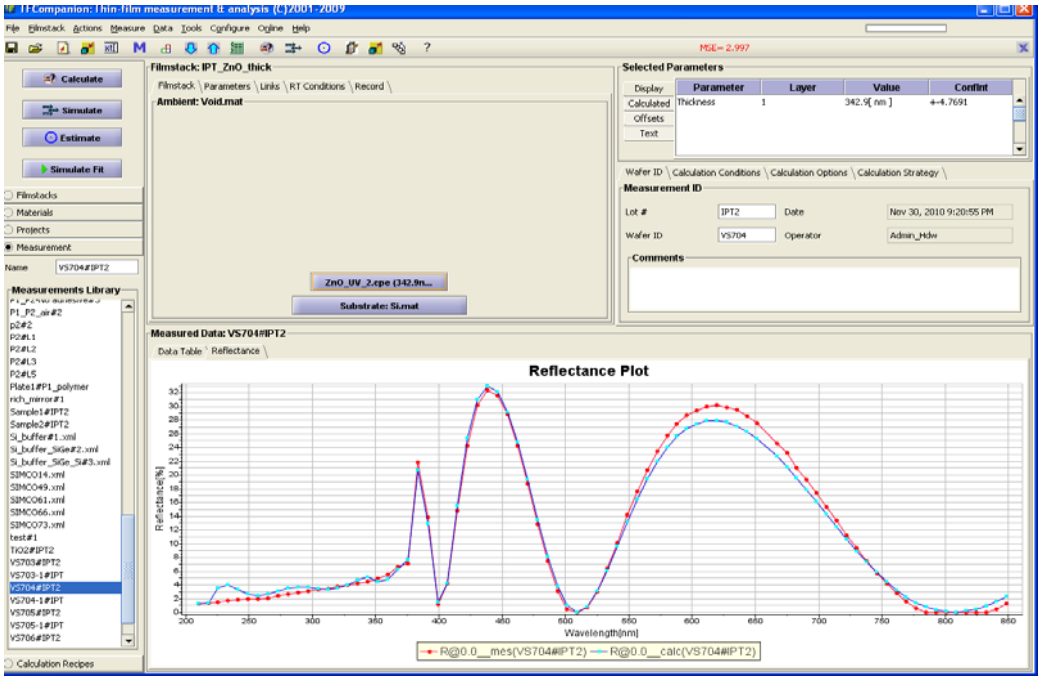

Fig. 4 Thick ZnO film: fit of the model to measured data. Thickness and optical dispersion are determined from the fit. Thickness: 342 nm

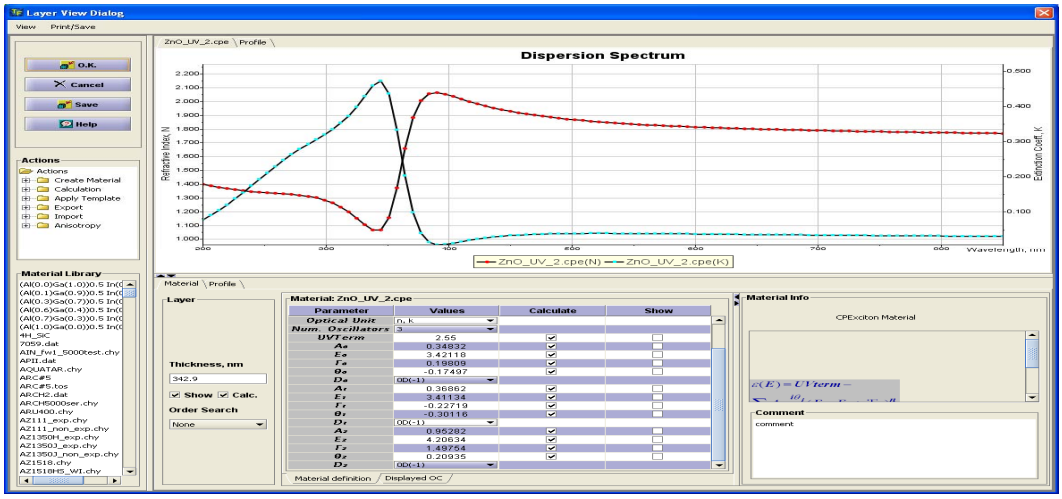

Fig. 5 Optical dispersion of the ZnO determined from the measurement of the thick ZnO sample. Dispersion is represented using CP Exciton model

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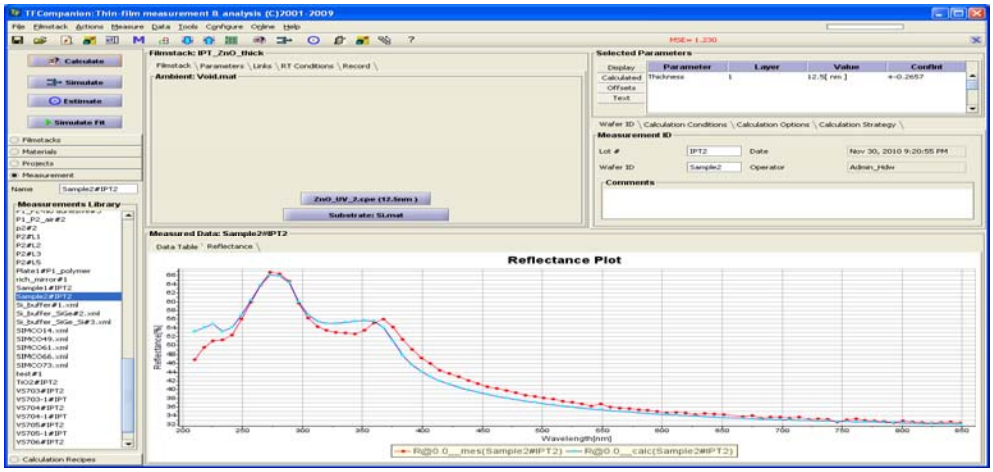

Fig. 6. Thin ZnO sample. Model to measurement fit using optical dispersion determined from the thick ZnO sample. Thickness: 12nm. Discrepancies in the fit indicate that optical properties of the thin ZnO sample are different from the thick one – it appears more amorphous.

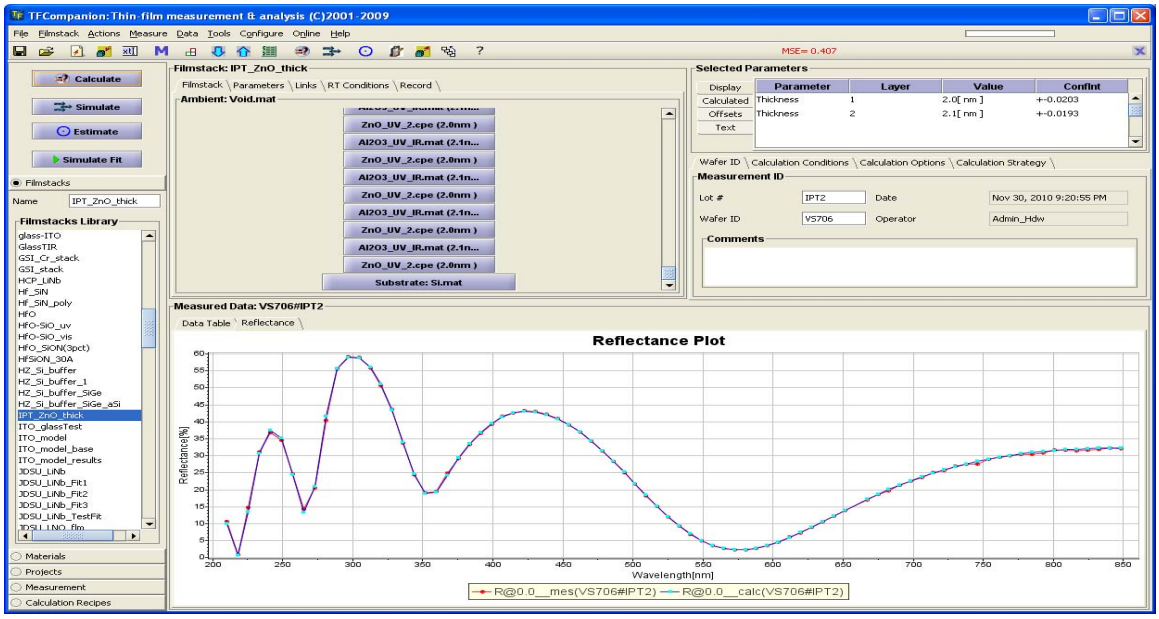

Fig. 7 Model fit to the measured data for (2.0 nm ZnO/2.1nm Alumina)x60 /Si heterostructure sample. Thicknesses of Alumina and ZnO layers were determined - all repeated layer were assumed the same (same thickness and dispersion). ZnO dispersion was determined from the measurement.

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Fig. 8. ZnO dispersion determined from heterostructure measurement. Dispersion is smooth without critical point – indicating almost completely amorphous material.

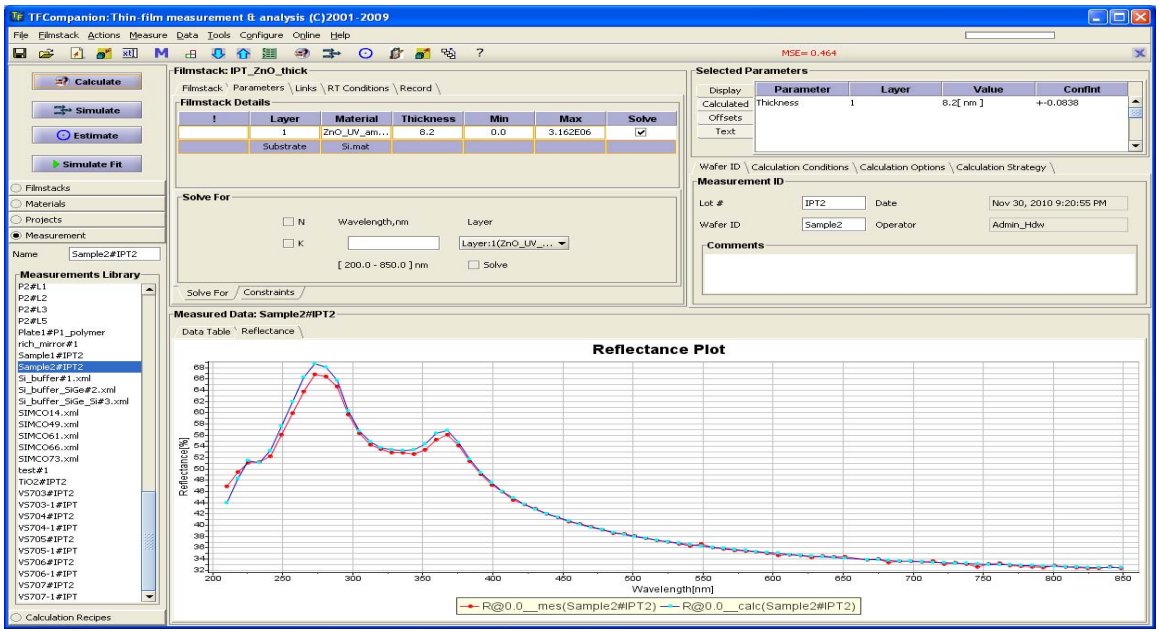

Fig. 9 ZnO dispersion determined from heterostructure measurement was used to analyze thin ZnO sample - to verify that it is indeed correct. The good fit shows that ZnO dispersion is the same in a single ZnO layer and ZnO layers in heterostructure.

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