Electronic Supplementary Material (ESI) for RSC Advances

A Comparative Study of the Structure and Optical Properties of Copper Sulfide Thin Films Chemically Deposited on Various Substrates

Tsofnat Safrani[1][2], Jürgen Jopp[2] and Yuval Golan[1][2]

[1] Department of Materials Engineering, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel.

[2] Ilse Katz Institute for Nanoscale Science and Technology, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel.

Fax: +972-8-6472944; Tel: +972-8-6466297; E-mail: ygolan@bgu.ac.il

Supplementary information on ellipsometry measurements:

The model consisted of a substrate, *Cauchy* layer (thin film) and air with refractive indices n_s, n_f and n_a=1 and extinction coefficients k_s, k_f and k_a=0, respectively. The values for n_f and k_f were approximated by *Cauchy* formulas (Eq. 1 and Eq. 2, were λ is in nm). The data of each measurement was divided into four sets (400-500 nm, 500-600 nm, 600-700 nm and 700-800 nm). In each interval the same fixed thickness value was used, and the six *Cauchy* parameters n_0, n_1, n_2, k_0, k_1 and k_2 were fitted (see Table 1). The fitting curves (delta (Δ) and psi (Ψ)) of each interval are shown in Figures 1 to 7 (the fitting curves of the last two intervals are not available).

$$n_f(\lambda) = n_0 + \frac{0.01 \times n_1}{\lambda^2} + \frac{10^{-7} \times n_2}{\lambda^4} \quad (1)$$

$$k_f(\lambda) = k_0 + \frac{0.01 \times k_1}{\lambda^2} + \frac{10^{-7} \times k_2}{\lambda^4} \quad (2)$$

Table 1: Fitting results of the six *Cauchy* parameters

Dataset	d [nm]	n0	n1	n2	k0	k1	k2
Cu_xS on GaAs 400-500 nm	59	1.283	3865.7	-4028.3	-0.42	2124.083	-466.139
Cu_xS on GaAs 500-600 nm	59	1.046	5289.2	-6078.1	-0.099	312.362	2048.006
Cu_xS on GaAs 600-700 nm	59	1.278	4354.1	-5693.1	-0.119	836.212	480.112
Cu_xS on GaAs 700-800 nm	59	1.574	2732.9	-5032.2	0.066	-495.547	2691.689
Cu_xS on Si 400-500 nm	75	0.877	4677.2	-4475.7	-0.628	3263.003	-1764.44
Cu_xS on Si 500-600 nm	75	0.681	5208.4	-4501.2	0.219	-882.159	3374.316
Cu_xS on Si 600-700 nm	75	1.645	-2129.1	9450.4	0.434	-2196.341	5503.363
Cu_xS on Si 700-800 nm	75	3.312	-16685.2	39997.9	1.578	-14560.945	39755.371
Cu_xS on Si 650-750 nm	75	2.188	-7530.5	22822.5	2.133	-17482.217	39993.316

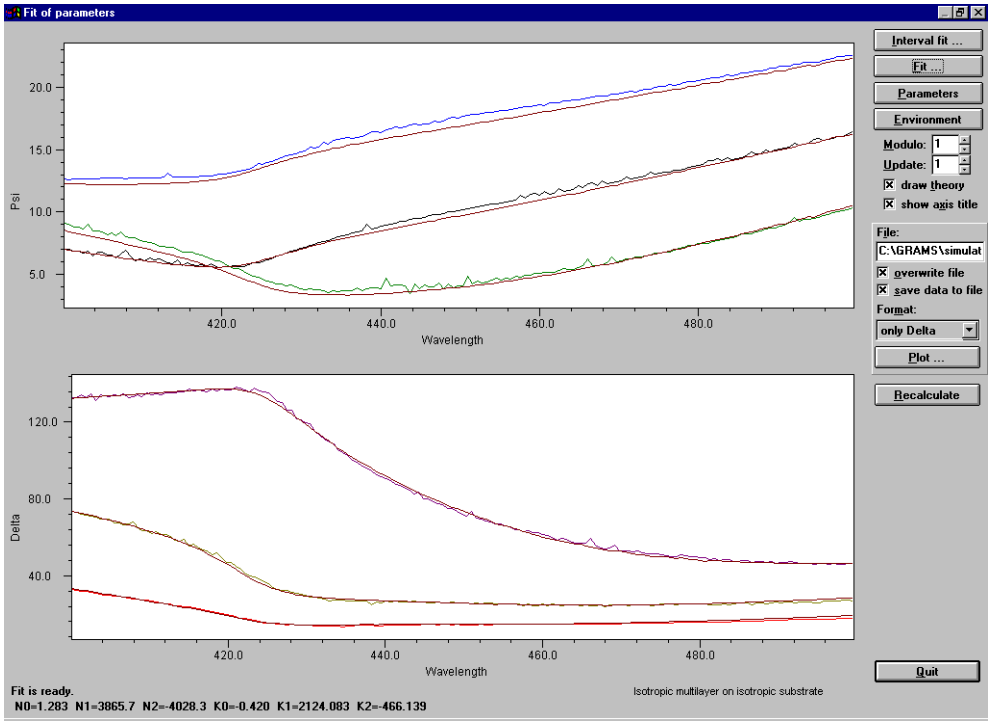

Figure 1: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on GaAs substrate in the 400-500nm wavelength interval.

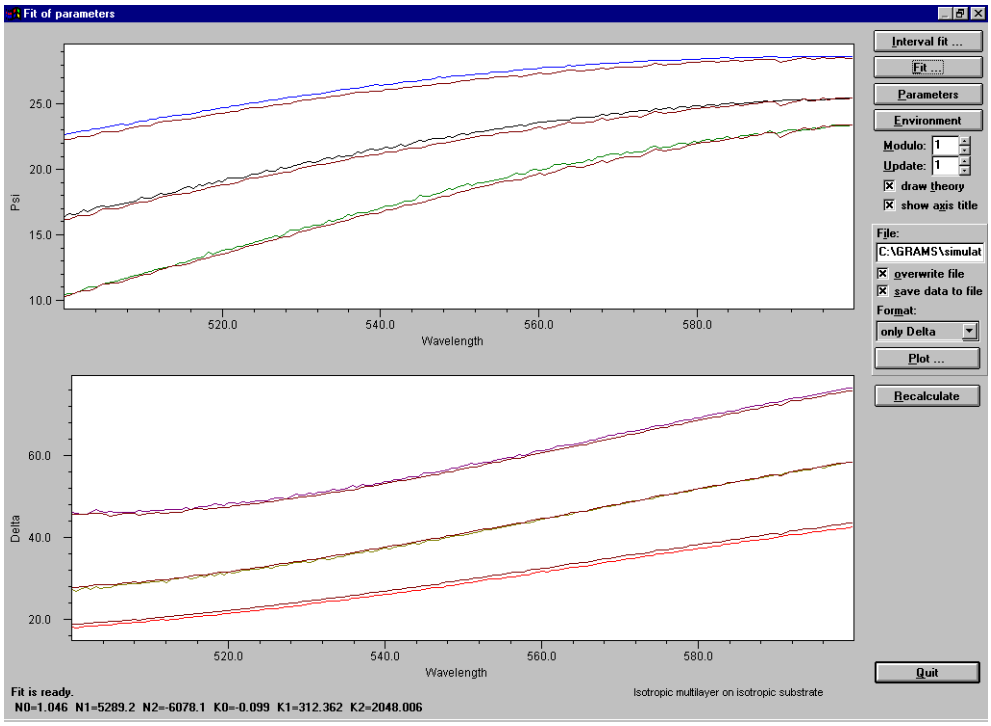

Figure 2: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on GaAs substrate in the 500-600nm wavelength interval.

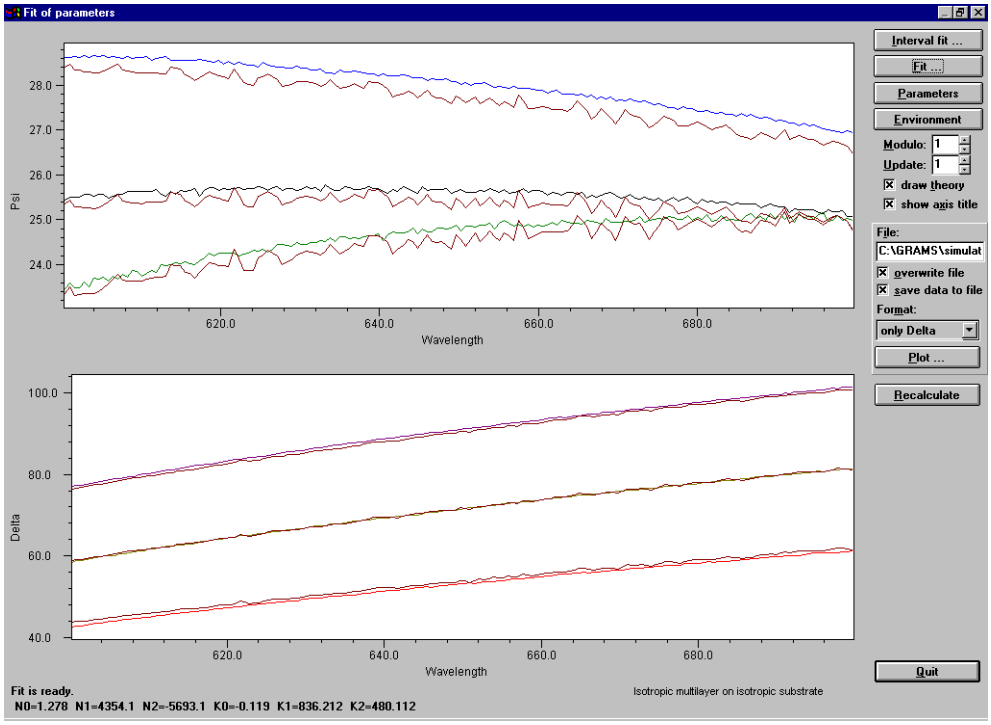

Figure 3: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on GaAs substrate in the 600-700nm wavelength interval.

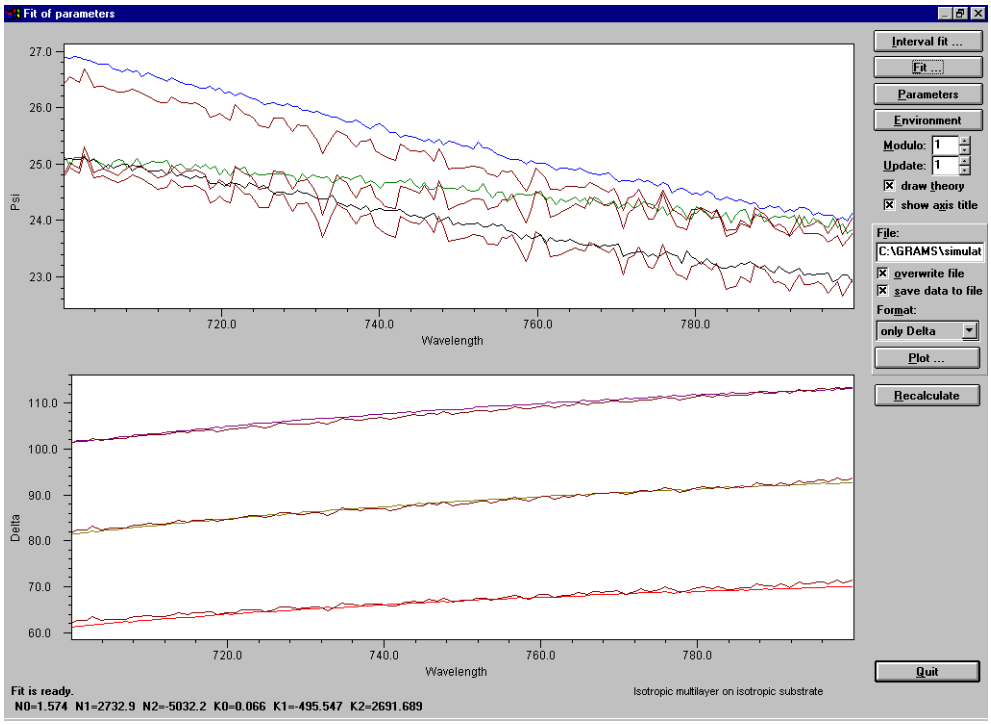

Figure 4: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on GaAs substrate in the 700-800nm wavelength interval.

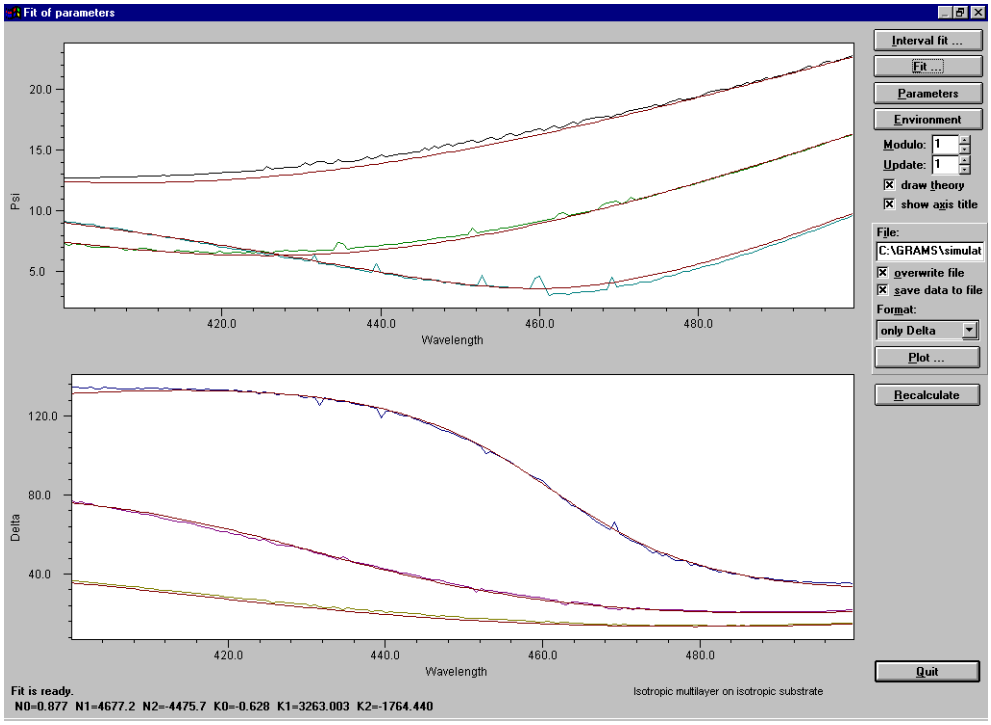

Figure 5: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on Si substrate in the 400-500nm wavelength interval.

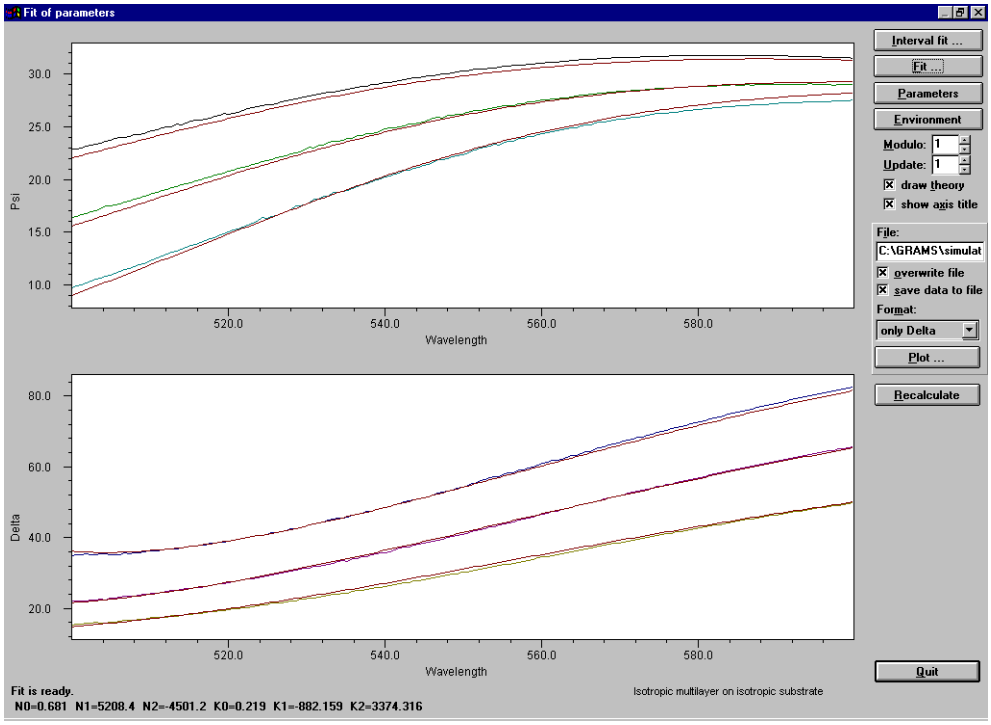

Figure 6: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on Si substrate in the 500-600nm wavelength interval.

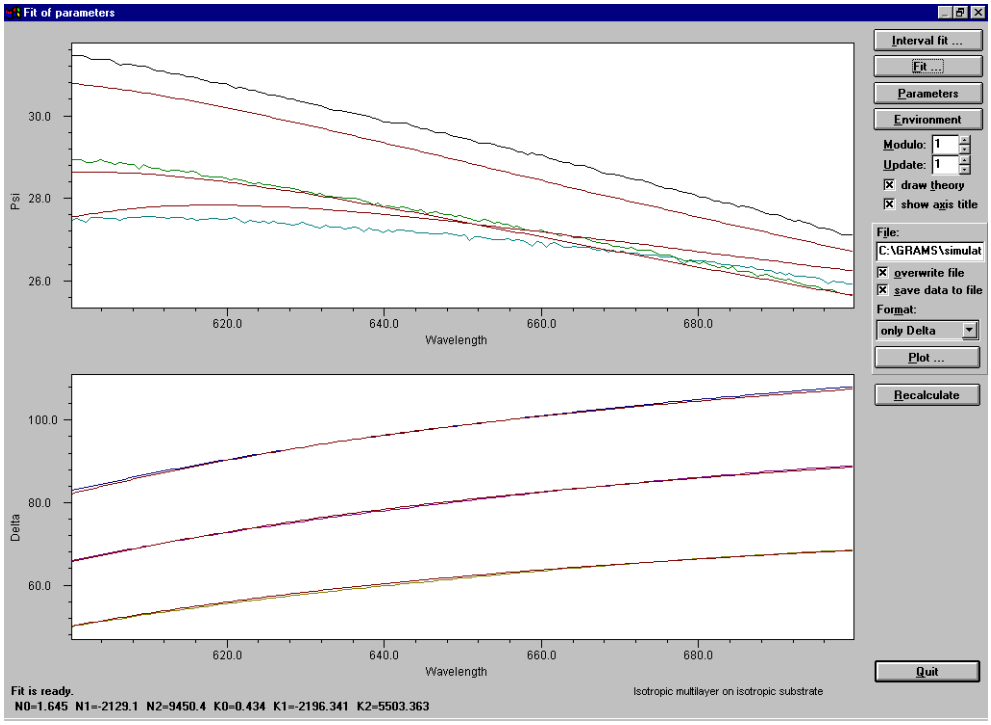

Figure 7: Delta (Δ) and psi (Ψ) fitting curves of Cu_xS films grown on Si substrate in the 600-700nm wavelength interval.