Featured Researcher:

Dr. James Elman, Eastman Kodak Company

It all began innocently enough in 1989 when Jim's thesis advisor at the University of Connecticut asked him to undertake two new projects: 1) buy a new ellipsometer and 2) perform neutron reflection experiments on thin polymer films at Argonne National Labs. Thirteen years later he is on his fifth Woollam instrument and sees "WVASE" whenever he closes his eyes. These ellipsometers include a vertical VASE, a horizontal VASE, two M2000's and the world's only FT (Fourier Transform) retardometer. Beyond Eastman Kodak Company, Jim also has access within the Rochester area to a Vacuum UV system (VUV-VASE) and a new AutoRetarder VASE system. "Now if I could just get someone to buy a mid IR system, we would be complete!"

If there is one common thread to Jim's research, it is the study of polymer films. As a manufacturer of imaging media, all of Kodak's products consist of layer upon layer of polymer films: some thin, some thick, most isotropic and some anisotropic. Characterizing these materials requires spectroscopic flexibility. The huge span of spectral regions available with Woollam instruments fulfills this need.

Anisotropic polymer films really utilize the power of Woollam ellipsometers. The 100 micron thick polyester film that forms the base of motion picture products is highly anisotropic, while cellulosic films intended for the liquid crystal display industry must have a very low (but controlled) optical anisotropy (retardance). Understanding these complex optical elements has lead to much collaboration with the Woollam Company [1, 2].

One final interest of Jim's is the application of WVASE32 modeling software to simple optical reflectivity spectra. Even though ellipsometry is the premier optical characterization method, there are times when it is not necessary or not possible (i.e. spectra acquired from an optical microscope). In those cases normal incidence reflection provides enough information for WVASE32 to model. Examples include: analysis of silver halide grains, CCD sensors, and simple (but multitudinous) film thickness measurements on anisotropic substrates.

To finish the story on neutron reflection: in the bowels of WVASE's "data types" you will find "neutron" and "x-ray" reflection options. The neutron option was added to the code in 1991, resulting in one chapter of Jim's thesis and an article in Macromolecules [3]. Modeling these data with WVASE32 made the task infinitely easier; many thanks again to Blaine Johs!

1. J. F. Elman, J. Greener, C. M. Herzinger, B. Johs, " Characterization of biaxially stretched plastic films by generalized ellipsometry," Thin Solid Films 313-314 (1998) pg. 814-818.

2. J. N. Hilfiker, C. M. Herzinger, C. L. Bungay, J. A. Woollam, and J. F. Elman, "Optical characterization of anisotropic plastics," in Optical Interference Coatings, Vol. 9, OSA Technical Digest Series, (Optical Society of America, Washington DC, 1998), pg. 190-192.

3. J. F. Elman et al., Macromolecules, 27, (1994), pg. 5341.

Dr. James Elman and Anne Miller working with their new M-2000