Featured Researcher:
Prof. Ludvik Martinu

In 1985, Dr. Ludvik Martinu completed his Ph.D. at Charles University in Prague (the oldest university in central Europe), where he studied nanocomposite films formed by metal clusters in dielectric matrices fabricated by a hybrid PECVD/PVD process. Following graduation, he worked as a research scientist, first at Charles University and then at the University of Bari in Italy, before securing a teaching position at Ecole Polytechnique in Montreal, Canada (1988). There, Professor Martinu heads the research on optical coatings and optical film systems. These efforts are part of the activities within the Plasma Processing Laboratory of the Engineering Physics Department. At the same time, these activities are part of a Thin Film Research Center (Groupe de recherché en physique et technologie des couches minces), of which Professor Martinu is associate director. He also actively collaborates with industry, in particular with JDS Uniphase/OCLI, Denton Vacuum LLC, Chessen Group, and others.

His main research activities involve:

Optical Thin Films: Coatings are used for many optical applications, where their material characteristics are important. In addition to mechanical properties, the basic optical properties (refractive index, extinction coefficient, optical loss) are critical to the performance of an optical thin film. Ludvik and his research group use a JAWCo™ VASE® instrument to determine the optical properties of new optical materials, specifically those fabricated by plasma enhanced chemical vapor deposition (PECVD).

Optical Systems: Many optical thin film systems can be constructed from transparent dielectric coatings; this includes AR coatings, bandpass filters, edge filters, hot/cold mirrors, and optical waveguides. These systems may involve single-layer, multilayer, graded index, and nanocomposite optical coatings. The performance of these devices depends on the material properties of each layer. VASE® characterization helps choose appropriate materials and film deposition processes.

In-situ: Many optical systems involve complexity that warrant *in situ* process monitoring to maintain quality devices. Real-time diagnostics and possible feedback control at high deposition rates and high measurement speeds are being investigated using a JAWCo™ M-44.

Spectroscopic ellipsometry is an important materials characterization technique for each of these research activities. It is routinely used by about eight students in Professor Martinu's group, often representing their principal research tool. Their repertoire of ellipsometers will soon include an IR-VASE® and an M-2000®. Ludvik's group publishes extensively and much of their work includes results based on ellipsometry:

L. Martinu and D. Poitras, "Plasma Deposition of Optical Films and Coatings: A Review", J. Vac. Sci. Technol. A, 18 (2000) 2619-2645.

A. Bergeron, D. Poitras, and L. Martinu, "Interphase in Plasma-deposited Silicon Nitride Optical Films on Polycarbonate: In-situ Ellipsometric Characterization", Opt. Eng., 39(2000) 825.

D. Dalacu and L. Martinu, "Spectroellipsometric Characterization of Plasma-deposited Au/SiO2 Nanocomposite Films", J. Appl. Phys., 87 (2000) 228.

D. Dalacu and L. Martinu, "Temperature Dependence of the Surface Plasmon Resonance in Au/SiO_2 Films", Appl. Phys. Lett., 77 (2000) 4283-4285.

S.G. Wallace, B.J. Robinson, P. Mascher, H.K. Haugen, D.A. Thompson, D. Dalacu, and L. Martinu, "Refractive Indices of InGaAsP Lattice-matched to GaAs at Wavelengths Relevant to Device Design", Appl. Phys. Letters, 26 (2000) 2791-2793.

D. Dalacu and L. Martinu, "Optical Properties of Discontinuous Gold Films: Finite Size Effects", J. Opt. Soc. Am. B, 18 (2001) 85-90.

A. Bergeron, J.E. Kemberg-Sapieha, and L. Martinu, "Structure of the Interfacial Region between Polycarbonate and Plasma-deposited $SiN_{1.3}$ and SiO_2 Optical Coatings Studied by Ellipsometry", J. Vac. Sci. Technol. A, 16, (1998) 3227-3234.