Center for Coatings Research (CCR)

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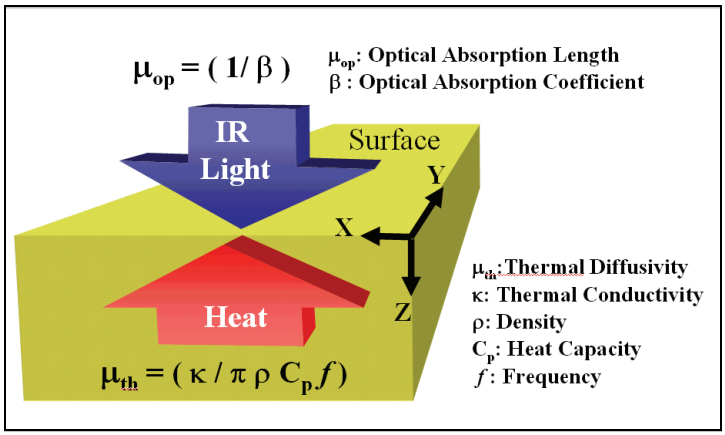
Center website: http://www.nsf.gov/pubs/2002/nsf01168/nsf01168l.htm

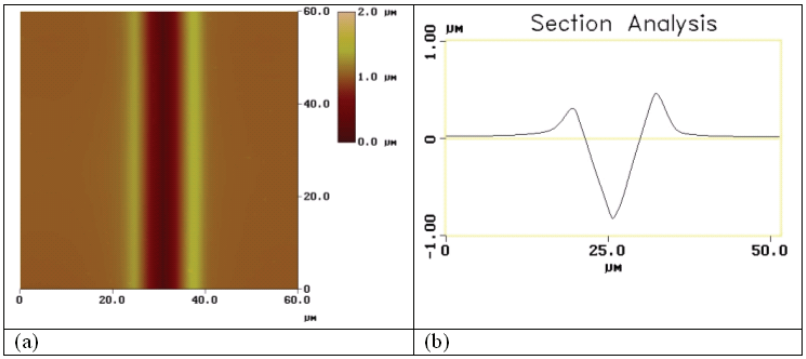
Coating Analysis with Step-Scan Photo-Acoustic FTIR Spectroscopy



Researchers at the Center for Coatings Research (CCR) have developed a technique to analyze the chemical composition of single or multi-layer coatings. This enabling technology uses step-scan photo-acoustic Fourier-Transform Infrared (FTIR) spectroscopy to provide a means of non-destructive analysis of coatings. The chemical composition as a function of depth of the coating can be determined to provide a compositional map as a function of coating depth. The adhesion of each layer can be related to the chemical composition at the interface. In addition, Dr. Urban has developed a high-resolution FTIR imaging capability that can map out the composition of the top surface of the coating as a function of position on the surface with a spatial resolution overcoming the typical infrared detection limits. In another development, rheo photo-acoustic FTIR for stress-strain measurements provides the ability to analyze adhesion at the molecular level, particularly for plastics. The technology has been used by Ford to study degradation of coatings and by a wide range of other companies, including BASF, Bayer, Air Products, Huber, as well as government agencies such as the Office of Naval Research. For more information, contact Marek Urban, 601.266.6454, marek.urban@usm.edu.

Scratch Resistance of Coatings Measured by Modified Scanning Probe Microscope (SPM)

Researchers at the Center for Coatings Research (CCR) have developed a technique of using a modified scanning probe microscope (SPM) with a custom-made diamond probe as a tool to measure the mar resistance of coatings quantitatively. The coating suppliers of GM, Ford and Chrysler, such as PPG, Akzo Nobel, Red Spot, etc. have utilized the technique to characterize their products and improve the mar/scratch resistance of the coatings.



As nano-tribology advances, demand for new instruments capable of carrying micro/nano indentation and scratching measurements increases. The newly developed Nano-indenters can perform both indentation and scratching tests at the micro/nano scale. The technique can not only measure the mar resistance quantitatively, but can also, for the first time, identify the responses of coatings to marring and scratching, i.e., immediate elastic recovery, plastic deformation, and abrasive wear, as well as viscoelastic creep, quantitatively. A Nano-indenter was purchased in the Surface Science and Nano-tribology lab. Now, the Nano-indenter is used for controlled damage, and SPM is used to examine the damaged surface and study the wear mechanism. The applications of the technique are extended to study adhesion of ink deposited on plastic films (Sun Chemical Company), automotive polycarbonate glazing systems (EXATEC), multilayer organic/inorganic coatings over brass surfaces (MASCO Corporation), very soft latex coatings on hard surfaces, among other applications. For more information, contact Weidian Shen, 734.487.8797, wade.shen@emich.edu, or Frank Jones, 734.487.2203, frank.jones@emich.edu.

Solvent-less "Green Coatings"

The Center for Coatings Research has made numerous contributions in the areas of new resins for coatings and new characterization techniques. Perhaps the single most noteworthy contribution has been the synthesis of new polymers and oligomers for "green coatings." This includes the development of tailored oligomers for solvent-less liquid coatings and the use of bio-derived resins, mostly based on soybean oil. These solvent-less coatings are very good for the environment. Environmental pollutants are greatly diminished from those produced by typical solvents. For more information, contact Frank Jones at frank.jones@emich.edu or Jamil Baghdachi at 734.487.2040, jamil.baghdachi@emich.edu.