MiCROVISION LABORATORIES, INC.

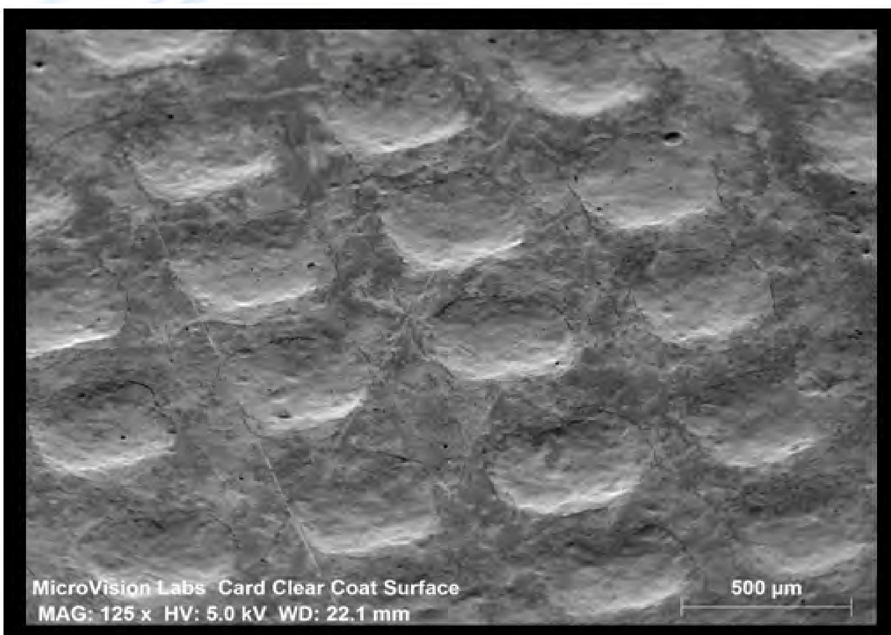
The Anatomy of a Playing Card

(part 2 - Scanning Electron Microscopy)

The purpose of this examination is to highlight and demonstrate analytical techniques that we have here at MicroVision Labs which can be used in the graphic arts medium. A playing card is an excellent example of something so commonplace that one normally does not connote any sophistication with it at first glance, but in reality they have a complex structure and engineering behind them. In part one of the series we examined the different optical microscopy techniques this week we are explore a completely different type of imaging.

An SEM is a very powerful microscope (typical magnification range from ~10X to over 100,000X) which uses a thin focused beam of electrons to produce an image by scanning over the surface of the sample. Electrons from the very surface of the sample are collected by a detector, amplified, and scanned across a computer monitor in synch with the beam that is scanning across the sample. The brightness of any pixel on the monitor corresponds to the amount of electrons, or signal, collected from the corresponding point on the sample when the electron beam passes over it. The pattern of the scanning beam, or the raster pattern, thus generates the image we see.

The SEM can operate at a wide range of magnifications, including very high magnifications, and produce images with incredible resolution and great depth of field. It can outperform any other common type of microscope, even at very low magnifications. The SEM is extremely useful tool for morphological investigations, sizing and particle counting. It also allows for non-destructive analysis of most samples.



At 125X magnification we can clearly see the embossed surface of the card in the image above. As previously stated the cards are embossed to induce slip. This is similar to the surface of a golf ball and is meant to induce the Bernoulli Effect. Dimples on the card surface create a thin turbulent boundary layer of air. This creates a small amount of distance between the surfaces of the two cards allowing them to glide past one another.

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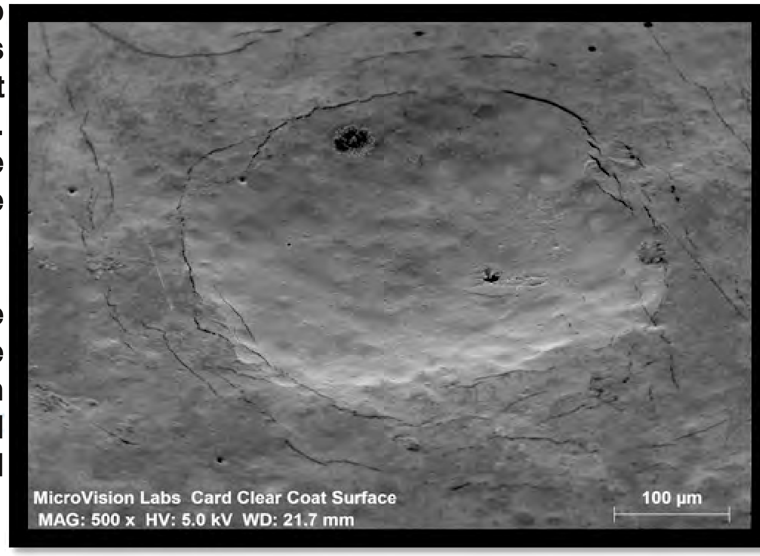
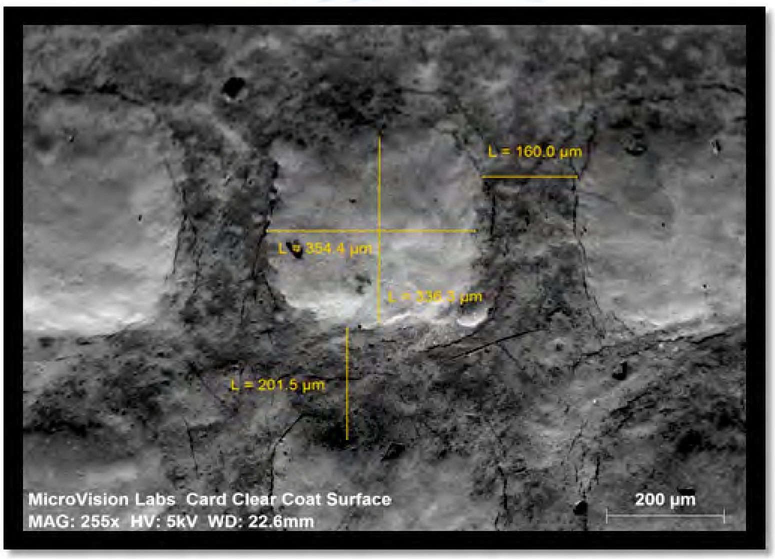
SEM allows for more accurate and close examination of the surface of the card, without any optical interference. The bombardment and collection of electrons makes the surface topography clearly visible. The SEM also makes it possible to take exact measurements of features on the card even allowing for tilt and angle at which the image is taken. Whereas before with optical microscopy we were unable to see hairline fractures in the coating, here they are visible.



Accurate measurements are also possible with SEM imaging. In this picture we have measured the dimples and the space between them. This can be done fairly quickly and requires no calibration against a standardized background like with optical microscopy.



With these measurements it is possible to do comparisons against an embossing roller or gravure cylinder or any other transfer media to do size comparisons. This allows the user to capture the delta between the two and make any desired adjustment in size. This application could also translate to dot size or a measuring a particular lamination feature.

The next installment from us at MicroVision Labs will be Part 3, Inside Out: Analysis of topography and inorganics by cross sectioning using Scanning Electron Microscopy and Elemental Dispersive Spectroscopy with mapping techniques.

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