Summary and conclusion

X-Rite recently introduced the MA-T6 and MA-T12 spectrophotometers as a worthy successor/extension of their current MA9x series. The instruments are also a response to the BYK-mac instrument from BYK-Gardner.

The BYK-mac was developed during the TARBAM project between 2002 and 2007 by BYK-Gardner, AkzoNobel and Merck. The author of this article was project leader for AkzoNobel and of course very curious to see competing instruments entering the market. Although it took 10 years to come up with a proper answer it finally arrived with substantial bonuses.

Being the AkzoNobel project leader of the BYK-mac instrument I know what the BYK-mac can and cannot do. X-Rite gave me the opportunity to have access to their scientific reports and researchers. For anyone knowing X-Rite this is a unique situation. I was pleasantly surprised by the efforts X-Rite went through to develop the MA-T instruments and the difficult choices that sometimes needed to be made.

It can be concluded that the MA-T instruments will build trustworthy color and texture (sparkle and coarseness) databases that will improve color matching and color searching results. I advise (big) paint companies and OEM manufactures to have a very close look at the MA-T instruments because they provide unique information to further digitize color processes.

In this article, I will go into various aspects of the new instruments.
The MA-T spectrophotometers in brief

The MA-T spectrophotometers are multi angle spectrophotometers measuring color under 6 respectively 12 angles and both instruments also measure texture under 6 + 1 (sparkle + coarseness) geometries. The 6 geometries to measure color of the MA-T6 are compatible with the BYK-mac. The MA-T12 has 6 additional geometries that are especially useful to measure interference colors. The texture measurement uses a calibrated HDR color camera instead of a simpler black and white camera.

The instruments are meant to be used for effect coatings like metallic and pearlescent colors and of course solid colors as well. QC software is available to measure and manage color standards. There are rumors that new exciting color matching software is under development.

How do the X-Rite MA-T spectrophotometers stand out from the competition?

The following subjects came up during my interviews and discussions with X-Rite experts where they explained the new features of the MA-T instruments.

Color measurement
The MA-T12 works with 12 spectral (color) measurement geometries that will generate a complete footprint of color data of an effect coating. Depending on the ‘exoticness’ of the measured color the added value of more geometries will become apparent. For QC purposes, it is wise to restrict the number of geometries to monitor color. However, for data completeness and to learn from historical (big) data analysis the extra information can help to draw new conclusions and discover new connections.

Sparkle measurement
Related to the sparkle/glint and coarseness properties of effect coatings X-Rite convinced me that they put a lot of effort to correct for current issues especially with sparkle measured with the BYK-mac. Although quite some companies benefit from the sparkle values for effect coatings there is significant room to improve. The Automotive OEM market is losing its confidence in sparkle aspects because the precision of the BYK-mac to measure these aspects appears to be inadequate. In addition, the currently used sparkle quantities Sparkle Grade (SG), Sparkle Area (SA) and Sparkle intensity (SI) are in one word awful complicated and discourage the use of sparkle.

It is remarkable that AkzoNobel being a member of the TARBAM development team never used more than one aspect to describe sparkle (denoted as glint index). Also, the extensive visual experiments carried out by X-Rite have shown no reason to introduce more than one number for sparkle. In fact, tolerances for sparkle can be expressed in a single number. This simplification also releases specifications from the very complicated tolerance ellipses combined with hyperbolic graphs to control sparkle.
To increase the value of sparkle X-Rite took an effort to make sure that the steps between the sparkle grades are equal. This process of linearization took quite some effort but delivered an improved result. This improvement will add value in color bank search and color matching.

**Colored Sparkle measurement**

One of the most exciting new features of the MA-T instruments is the use of a color camera instead of a black and white camera as in the BYK-mac. Now the color variations seen in images can be used to help in identifying the effect pigments used in effect colors. In addition, the quality of the images is enhanced by the fact that they are corrected using the spectral data of the same color measuring geometries and because the images are made using HDR techniques. X-Rite will introduce a new technology using colored sparkle HDR images to improve effect pigment identification. Perhaps this will bring fully automatic color formulation with effect pigments closer to reality, which until now requires microscopy to identify these effect pigments.

The 6 +1 sparkle measurement geometries better describe the angular dependence of the sparkle phenomenon from near specular to far specular. Furthermore, the color variation of the sparkle spot can be observed in the different measurement geometries.

Fig 1. Example of textural images showing variation in color of sparkles
X-Rite is so convinced of the added value of these color calibrated pictures that they make them publicly available through an open data format and accompanying tools. Every researcher in the private sector and universities will have a unique opportunity to perform analysis on their own images.

Displaying effect coatings on screen is difficult but helps some businesses like the Car Refinish body shops to get an indication of the repaired color. The colored sparkle feature of the MA-T’s will help companies to high fidelity images of complex effect colors on screen.

**Where do the X-Rite MA-T spectrophotometers have a challenge?**

I see two aspects of the MA-T spectrophotometers that could form a challenge for a successful introduction:

**Form factor:** Compared to the BYK-mac the MA-T instruments clearly have a somewhat different form factor which is caused by the different optical components. At first sight, the MA-T instruments look a bit bulkier although it is actually similar in volume and weight. Practice however, will show that it’s easy to get used to the instrument because the MA-T gives a firm grip as the casing material is completely anti-slip. An important practical aspect of portable measuring instruments. Indicators on the screen showing an image of the measuring spot and the three pressure sensors also help to take proper measurements.
Color Performance: We had insight in the color performance values i.e. spectral information and calculated color values. Repeatability and reproducibility of the BYK-mac are slightly better, but given the large variations in spectral reflectance values of colors in the automotive industry, the differences in reproducibility do not seem to be a big issue. In other words, the reflectance variations over a single effect color panel are many times higher than the differences in reproducibility. The article of Erik Kirchner and Jyotsna Ravi: “Setting Tolerances on Color and Texture for Automotive Coatings”, Color Research and Application gives more background on required tolerance levels.

What are the compatibility aspects?

I expect the MA-T instruments to measure virtually the same color and texture difference values between a standard and a sample as the BYK-mac. Although the geometries to measure sparkle in the MA-T spectrophotometers differs from those used in the BYK-mac there is a good correlation. In addition, as mentioned earlier the market is waiting for an instrument that measures sparkle in a more reproducible and consistent way.

In general, for companies already using multi angle color measuring equipment, it is important to consider compatibility issues when they want to switch to other instruments. In case of full compatibility a hard switch is straightforward but in the case of complex measuring equipment like the BYK-mac and the MA-T this is more complex.

The difficulty to switch will depend on the specific customer processes.

For QC in OEM Automotive (car manufacturers) the huge amount of information coming from the MA-T instruments will help them to set better tolerances. Because the number of colors for OEM manufacturers is limited, a vectorial shift can help to compensate for the systematic reflectance differences between instruments made with the current equipment (like BYK-mac) and the new MA-T instruments.
For quality control of paint batches switching to the MA-T instruments will be less problematic. QC of paint batches is always associated with shifting white and sometimes black paint color standards. Setting new standard levels can be done based on the last delivered color batches. Together with the fact that the currently used tolerances can be deployed, the transfer process can be done relatively quickly. And of course, it is not a bad idea to start with a clean slate for QC paint batches anyway.

For automotive paint companies, the easiest way to switch would be to rebuild the established databases. This is difficult but not impossible. Where automotive coating colors degraded over time in the past, they are today very stable with modern coatings. Therefore, building new databases is a matter of remeasuring panels. If well-organized this is a manageable activity. Of course, the panels should be available, which in my experience is not always the case.

**Finally**

We should realize that a new era of color digitization started taking advanced machines like the MA-T spectrophotometers into account in combination with big data machine learning algorithms which are hungry for independent and complete information about color. In addition, processes like dosing, mixing, spraying and measuring are more and more automated. It is no longer enough to simply perform measurements for procedures like quality control and color matching. Automation and learning from analyzing data is the new way to improve processes.

**About the author:**

**Roel Gottenbos:** is an experienced color research manager and developer of game changing color tools. He helps companies to improve their color processes from raw material to end product. Within Color Technology Consultancy Roel has the privilege to work together with Erik van Biemen who is as passionate and knowledgeable about color.