Understanding xDNA terms

The xDNA proprietary method of analyzing effect paints is a very powerful tool for today's manufacturers. Used to its fullest potential, xDNA can save companies substantial time and money in:

- Implementing new processes;
- Monitoring existing processes, and;
- Troubleshooting problems if they occur on the shop floor.

The key to using xDNA to its greatest capability is proper interpretation of its data. To simplify the analysis, take a stair-step approach—starting with the raw data generated from the MA98 instrument as the starting point.

Step 1 – Generate the raw data

The xDNA signature for a particular surface created by a specific process will change in size and shape as either the formulation or the process is altered. That is the power of xDNA—the ability to discern when something has changed from the standard.

xDNA: X-Rite Dynamic Numerical Analysis—the coating gene. xDNA measures the process and formulation that is actually applied to the part. The xDNA curve of a multiangle measurement is the vector summation of each viewing direction, with each direction weighted by the reflectance in that direction

Step 2 – Transform the data

You can easily compare if two 2-dimensional images are identical by placing one on top of another, similar to the way you can quickly see differences between two photographs by placing one negative over the other.

That is essentially what the X-ColorQC software does to compare two xDNA profiles, but the images are compared mathematically and the calculations are more complex because the profiles have 3 dimensions.

Regardless of the equations used, xDNA generates easy-to-understand graphs that indicate how close two profiles match.

The profiles are transformed three ways: translate, align and scale.

xDNAt: The xDNA expression representing the translation, which helps to assess the change in process.

xDNAa: The xDNA expression relating to alignment that represents the in-plane angular difference of xDNA curves. It is related principally to flake size and orientation.

xDNAs: The xDNA expression representing the difference in size of xDNA curves. It is affected by ingredient changes and process changes that essentially act as ingredient changes, such as an adjustment to a painting process that significantly reduces the number of larger, heavier flakes from reaching the part surface.

Step 3 – Analyze the data by its physical characteristics

Now that the raw data has been transformed, the next step is to measure the difference between one profile and another.

dDNA: The formulation and process difference in xDNA. A dDNA calculation can be analyzed at any stage of the process. It is NOT perceptually weighted and so preserves the wavelength dependence characteristics of light scatter in the material. It provides a direct metric to process and formulation variation.

dDNAt: The difference calculation that indicates the translation of the transformed spectrum of the xDNA profile. Because dDNAt is most sensitive to process changes, this measurement is useful in setting and quantifying process tolerances and monitoring parameters that have marked effects on processes.

dDNAa: The difference calculation that indicates the first two rotations of the transformed spectrum of an xDNA profile. Rotation is typically a characteristic that is coupled both to changes in process and recipe distribution. For example, personnel may observe a difference in a painting process rotation that is due to a change in process that results either in a distribution change in the size of particles in a recipe, or a change in size and / or orientation of particles that adhere to the sample due to these changes.

dDNAs: The difference calculation that indicates the scale or magnitude of the transformed spectrum of an xDNA profile. This measurement is useful in quantifying the "sparkle" of surfaces (gonio independent) because it correlates with the flake size and distribution of the reflective additives of a recipe or formula.

Step 4 – Analyze the data by its perceptual characteristics

The beauty of xDNA is that it can act as a reliable predictor as to whether a person will be able to perceive a difference in two samples of effect paints—and why the samples look different.

This means that xDNA can help:

- Engineers to predict whether subtle changes in a process or formulation will greatly affect the color and appearance of products;
- Technicians and quality personnel to monitor processes that have subtle differences in process or formulation.

Similar to the way that 1 Delta E is defined as the distance in color space at which a human can typically begin to perceive a difference between a color and a slight variation of that color, 1 Delta F (dF, dFt, dFa, dFs) is defined as the distance in xDNA where a person may be able to distinguish differences in two mating parts. For instance, a person trained in inspecting painted products would have difficulty distinguishing between sample panels of two effect paints where the dF measurements fall below 1 on their graphs.

dF: This metric is related to a delta in xDNA that represents the visual difference under all potential lighting and observation geometries. This metric provides the key to relating perception to physical formulation and process variation. It is useful in setting perceptual based tolerances with direct relationship to formulation and process variables. Coarseness correlates with relative dF.

dFt: The delta in a transformed xDNA profile that relates to translation.

dFa: The delta in a transformed xDNA profile that relates to rotation.

dFs: The delta in a transformed xDNA profile that relates to scale or magnitude.