Color measurements with **BYKmac”i”**

Adjustments due to visible range fluorescence

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• Summary
It was found in single isolated cases of OEM coatings a colorimetrical discrepancy between Xrite and BYKmac

\[ dL^*da^*db^*(\text{sample-master})_{BYKmac} \neq dL^*da^*db^*(\text{sample-master})_{Xrite} \]

This phenomena was observed mainly in combination with different technologies (e.g., sb to wb or different clear coats). Some RAL standards (cards) show also this problem

In such cases a slightly different reflectance (\( \Delta \sim 10^{-3} \)) for wavelengths 450-550 nm

Theory: additionally visible fluorescent light reflection is not being captured by BYKmac

BYK-Gardner approach to solve this problem: the new BYKmac (i) can measure this kind of fluorescence with new sensors, filters and signal amplifiers. Two reflectance curves are thus for each sample determined (reflectance “normal” and adjusted with additional fluorescence)
Fluorescence detection

BYKmac

BYKmac“i”

Out of plane fluorescence sensors

Upgrade of existing BYK-mac
- Complete refurbishment of hardware
- Upgrade of LED illumination wheel
- New Analog Board
- New diffusing sphere
- Fluorescence detectors
- Color display
- New housing
Fluorescent pigment list
(BYK-Gardner results)

Organic pigments applied in automotive and industrial paints

- P.Y. 139: Yellow
- P.Y. 185: Yellow (not common in automotive OEM)
- P.R. 178: Red
- P.R. 179: Red
- P.R. 282: Red (not common in automotive OEM)
- P.O. 73: Orange
- P.V. 19: Violet (gamma modification)

Fluorescent light might appear when using these pigment types.
The fluorescence effect may be influenced by the production process and the interaction of the components.
wb silver with and w/o tint with perylene (<0.01% on total paint)

### Numerical color shift after fluorescence adjustment by a silver tinted with and without perylene

Reference = “zero line” = sample after fluorescence adjustment

Usually OEM batch tolerances are displayed as green dashed lines.
wb silver with perylene
(<0.01% on total paint)

color shift after fluorescence adjustment by a silver tinted with perylene
**Comparison Xrite, BYKmac(i), BYKmac**

perylene tinted silver, reference = pure silver

<table>
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<th>Xrite</th>
<th>BYKmac(i)</th>
<th>BYKmac</th>
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<td>Color space</td>
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Fluorescence adjustment “on”
Fluorescence adjustment for perylene tinted silver

Difference in the reflectance curves between the adjusted and not-adjusted color

Adjustment only significantly for very low reflectance values of the color → mainly the 110°
Fluorescence adjustments

color shift other pigments

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Dr. Vignolo – CO/TBC
Fluorescence adjustments

color shift other pigments (weighted with e.g. batch tolerances)
Fluorescence adjustments
perylene used in approx. full chromatic shades

dark perylene red
solid perylene red
Clear coat influence
perylene tinted silver with and w/o 2K clear coat (CC)

(1) BC 20’ at 140° w/o CC
(2) BC 10’ at 80° + CC 20’ at 140°
(3) Like (1) + CC 20’ at 140°
(4) Like (2) + CC 20’ at 140°
(5) Like (4) + oven at 140° again
concluding remarks

• **BYKmac(i)** can compensate some numerical color differences coming from a not completely understood phenomena «fluorescence»

• Different solvents in the formulation, technology (solvent or water), fineness of pigment grind but fundamentally the clear coat influences the measured results

• Due to the fluorescence adjustment simulates BYK better the Xrite readings. The visual assessment of some test samples did not validate or justify the adjustment (mainly 110°, deviation almost within the acceptance limits with BASF OEM pastes)

• Good Inter-instrument agreement of the “i” type to the old BYKmac (to one certified BYKmac is $\Delta_{avg} = 11\%$ of batch tolerances). Other studies at different OEMs confirm this behavior

• Perylene pigments basically in tinting quantities show the larger color shift after “fluorescence” adjustments
As recommendation, use BYKmac(i) always with the adjustment switched “on”

If some fluorescent effects are present, due to this adjustment the numerical discrepancy of BYKmac with other spectrophotometers using polychromatic light sources should be minimized.

For all the other “normal” cases no adjustment will take place and thus BYKmac(i) = BYKmac