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Research
and Development

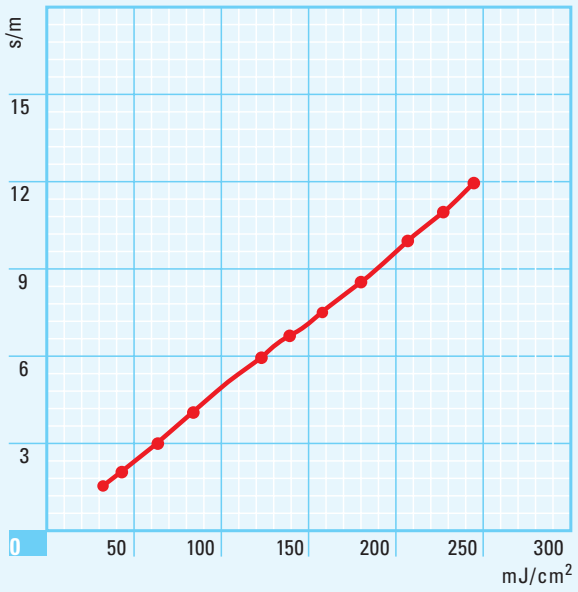
MEASUREMENT AND CONTROL OF UV-RADIATION DOSES USING TESA® UV-STRIPS

Hönle UV-Technologie offers a new system to measure UV radiation doses. This measurement system is based on a colorant, which develops under the influence of UV light followed by photometrical evaluation carried out with an instrument indicating the energy value in mJ/cm². Contrary to other known measuring processes based on measuring strips, the measurement results achieved with the Tesa strip are quite precise and reproducible. However, this accuracy is limited to measuring ranges of up to approx. 200 mJ/cm². Our laboratory has carried out tests with this system to determine its suitability for practical UV screen printing.

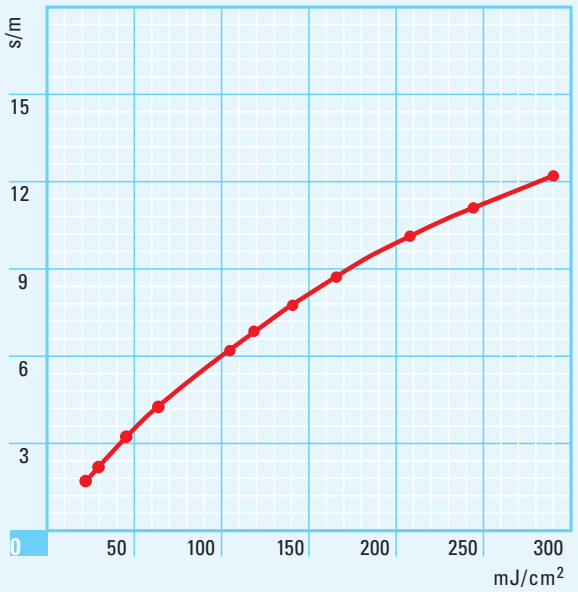
BASIC CONDITIONS

In technical screen printing applications many ink systems are cured with values exceeding 200 mJ/cm². Therefore this system is more suitable for highly reactive systems used for graphic screen applications. Generally screen printers use UV integrators to check lamp efficiency. These integrators show good and reproducible results, however the results obtained with different devices are often very different, above all if they are purchased from various manufacturers. Discussions about the required curing parameter can therefore be quite difficult. This is not extremely important for a mere check of lamp output in the UV-drier – e.g. to identify possible aging of the lamps or contamination of reflectors – as then you can only measure a relative change of the lamp output.

RADIATION DOSAGE KÜHNAST INTEGRATOR COMPARED TO BELT SPEED



RADIATION DOSAGE TESA STRIPS COMPARED TO BELT SPEED



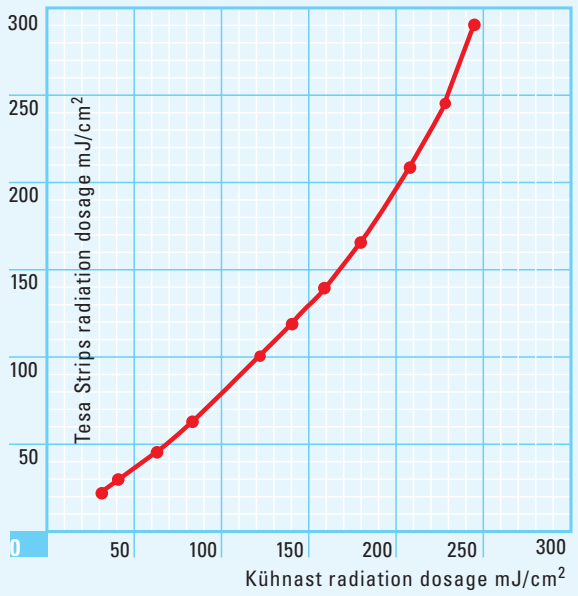
Comparison tests in our laboratory showed that the lamp output values measured with the Tesa/Hönle system are similar to those measured with the Kühnast integrator. With lower dosages the Tesa/Hönle system shows lower values than the Kühnast integrator and in a range of 200 mJ/cm² results of both systems are quite comparable.

In conformity with physical principles integrators show a good linearity, according to which doubling of belt speeds will result in bisection of lamp output. This inverse proportionality can easily be displayed in a diagram when the UV output is drawn in comparison to the reciprocal speed.

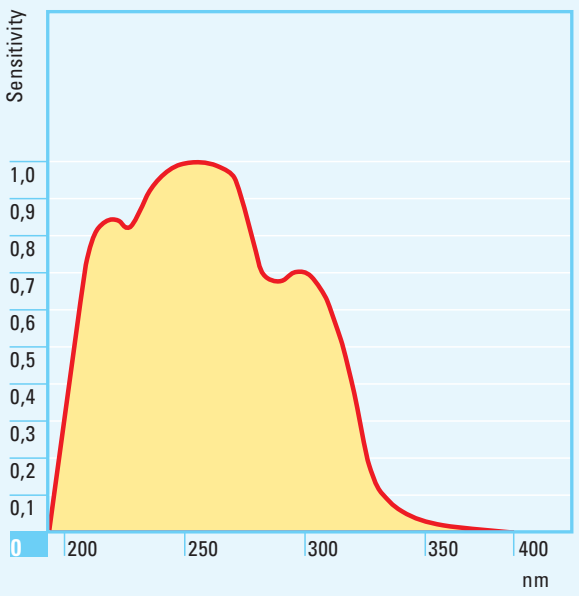
The Tesa/Hönle system does not have that linearity. In practical use this is not very important as only the relative changes of the UV radiation dosages are measured, however this fact explains, why the measuring data of both systems differ with increasing belt speeds.

* Insert strip

KÜHNAST INTEGRATOR COMPARED
TO TESA UV-STRIPS



SPECTRAL SENSITIVITY
OF TESA UV-STRIPS



COMPARE A WITH B?

On the whole a comparison of both measuring systems is not easily done as they are based on different measuring systems. This becomes clear when comparing the measuring results obtained with both systems.

According to the supplier the spectral sensitivity of the Tesa measuring strips (see chart) is approx. 250 nm. Wave lengths of 320 nm and more have only little influence on measurement of radiation dosages. The Kühnast UV integrator on the other hand will also take into account wave lengths of the UV-A spectrum.

This has been confirmed by the following test:

Belt speed of a Theimer UV-drier was set to 200 mJ/cm^2. The sensor of the integrator as well as the Tesa strip were covered with a blocking filter WG 320, so that only spectral ranges exceeding 320 nm could either have an effect on the system or the strip. The integrator showed a value of 168 mJ/cm^2, whereas the Hönle system only measured 4 mJ/cm^2.

The significance of these measuring values is quite relative due to the different spectral sensitivities. Comparable values are only reliable if the same radiators are used.

PRACTICAL USE

Both, discs and strips are suitable for regular checking of UV drier equipments. They are also a necessary tool to find the cause of problems in the manufacturing process. E.g. you can determine the efficiency of radiation reaching the edges if the inks on the substrate edges show a significantly lower curing as those in the middle.

Measurement of UV output is not only a possibility to increase daily process stability, but also an excellent tool for documentation of the manufacturing process.

Our UV curing process colours for graphic applications have a high reactivity. Tesa measuring strips show good suitability for such inks. A process print made with UVU on rigid PVC was cured in a belt drier together with an UV-strip. Depending on the amount of radiation applied, the strip develops a more or less intensive magenta shade, similar to that of the process colour.

UV process inks cure within an energy range which can easily be covered by Tesa strips

We find that the exposed measuring strip remains quite stable so that an evaluation is also possible after several days, provided the exposed strip is stored in a dark environment. In our opinion the foil wrapper of the strip is suitable to store the exposed strip. Repeated tests with exposed strips showed nearly identical measuring values, even after two weeks. The Tesa strip can be an aid for exchanging information about radiation dosages. It is also a suitable tool in their documentation. Exposed and re-packed strips can easily be mailed and ink manufacturers have a new possibility to support their customers.

ADVANTAGES AND DISADVANTAGES OF DIFFERENT METHODS

Integrators can only be used with horizontal belts. When printing from roll to roll you can hardly use a disc, then the strips are of advantage. On the other hand UV integrators are easier to handle as the measurement result is immediately displayed. Handling of strips is more complicated.

If printers want to use both measuring methods they can use a comparison chart of different measuring techniques in order to be able to converse uniform values of UV dosages. If a different measurement method was used, the comparison chart will allow a quick conversion to a corresponding comparison value.

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