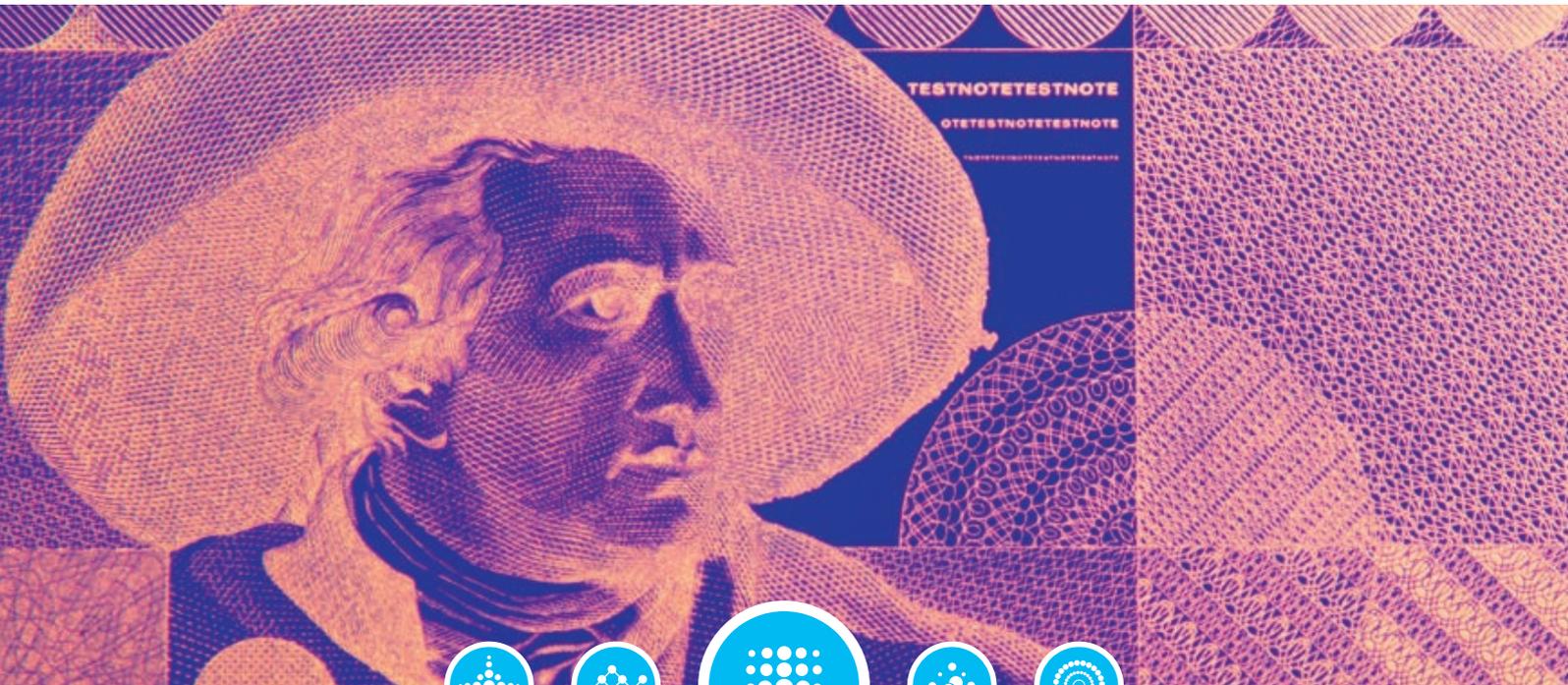


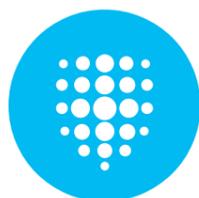


Leuchtstoffwerk Breitung GmbH

## Security pigments

MATERIAL-INTEGRATED AUTHENTICATION





## Security pigments at a glance

DESIGNATION	EXCITATION/EMISSION	SAMPLE APPLICATIONS
UV-VIS luminescence pigments	UV/VIS	Mono-, bi- and tri-luminescence
UV-VIS luminescence pigments in fibres	UV/VIS	Security thread
VIS-VIS luminescence pigments	VIS/VIS	Copy protection
Phosphorescence pigments	UV/VIS and VIS/VIS	After glow luminescence pigments
IR-IR luminescence pigments	IR/IR	Product identification
VIS-IR luminescence pigments	VIS/IR	Counterfeit protection
IR-VIS converters	IR/VIS	Document printing
IR absorbers	IR	Metameric printing, e.g. banknotes

UV = ultraviolet / VIS = visible light / IR = infrared

### Image credits

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*LWB security pigments are used in sophisticated applications such as banknotes, security documents and industrial products to verify product authenticity, provide robust proof of counterfeits, track products and prevent parallel trade or reimports. Our pigments and the detection technology are developed in close cooperation with our partners and are functionally interlinked.*

Our reliable light-resistant, chemical-resistant and heat-resistant inorganic security pigments can be easily incorporated in various carriers and materials. As such, they are an integral part of the end product and are virtually indestructible (Blue Wool Scale 8). It is impossible to remove, alter or replace the pigments in the product after the fact.

Our application laboratory supports the development by identifying the optimal pigment size, distribution and stabilisation in the desired target matrix, and conducting extensive testing for detection parameters and spectral analysis.

A direct sales channel and clearly regulated availability of the security pigments allow you to control quantities and use of the pigments every step of the way.





## Lasting solutions for brand integrity

The OECD estimates that counterfeit products now make up 3.3% of world trade. We can help you develop technical security measures and integrate them in company-wide product validation strategies.

Our modular system plays a big role in our individualisation concept: its foundation forms a broad basis of visible, invisible, detectable or machine-readable security pigments, with extra optical or functional components added. During what is known as a 'styling' process, we combine all elements into your specific, unique, custom-made solution.

**Process:**  
injection moulding, coating, printing, foil manufacture

**Materials:**  
textiles, paper (pulp), printing inks, synthetic fibres, polymers



The pigments are incorporated either through intermediate products such as toners, concentrates, additive pastes, master batches and chips, or directly as free-flowing pigments. This incorporation process can easily be set up to occur on-site, for seamless integration into existing production processes.

Our LWB experts will be happy to advise you, including helping you select or design suitable detectors and test equipment. Alternatively, we can develop all of the necessary components directly.

## Security is our top priority

Sensitive applications often require a wide range of different security features in order to allow for the broadest spectrum of tests in different processes and application areas.

Thanks to our modular system, different features can be individually combined: these authentication features actually verify each other in a process that comprises up to three levels. Combining features from the three levels has proved to be especially effective in practice.



Level 1 - visible

Level 2 - hidden

Level 3 - encoded

These security features are easily observable, as they can always be checked with the naked eye. No technical tools are necessary to determine the authenticity of the product.

Security features in this level cannot be seen with the naked eye and can only be checked by qualified observers using special light sources or different types of detection equipment.

These features are not just hidden, but also encrypted. They can only be identified and inspected in the product under very specific technical and informative conditions.



### *Our contribution to your future success on the market*

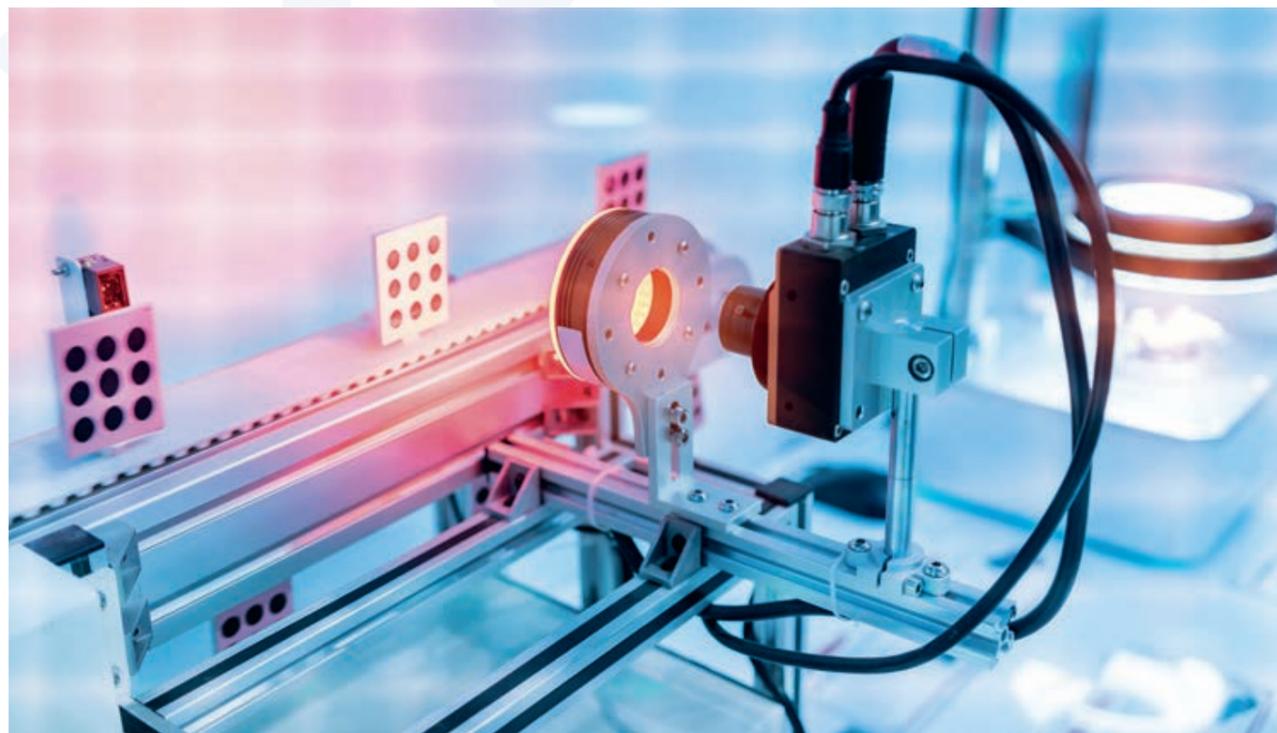
Our customers use our pigments to track, inspect and coordinate their products along the entire value chain.

Stable markers added to the raw material are the first building block in full and uninterrupted tracking, right up until the material is ready to be repurposed as a waste product. The features of these markers can be identified in every downstream process level through detection or analysis.

Special spectral properties of these markers give each material a unique fingerprint by simple means. This process can be designed so that an authenticity test can be performed simultaneously with every analysis.

The second building block in product tracking is detection and analysis technology that is adapted to suit the application at hand. Special measurement configurations, in combination with highly sensitive signal analysis, can be used to not only determine a material's origin, but also detect any additions, blends or dilutions.

The digital signature read out from the security pigment, working in conjunction with mobile or stationary test equipment and systematic data analysis, becomes a complete, reliable log of the authenticity, condition, quantity and location of the primary marked components.



### *We turn your ideas into products*

Our products are perfect for detection at high speeds in combination with great differentiation of features.

In collaboration with our partners, we offer a wide selection of hardware and software for this purpose. Our portfolio ranges from tried-and-tested standard solutions – which can be enhanced using freely configurable modules – and special calculation methods and database systems to cryptographic encryption of signals and data.

### *Reliable collaboration for complex tasks*

Our trusted network of collaborative development partners comprises highly specialised analytical and metrological companies, independent research institutes and universities. The expert knowledge from these specialist areas and the supplemental research approaches are all incorporated into our processes.

A number of solution-oriented, practical innovations have already been developed in the LWB research network:

- Efficient detectors for simple yes/no testing
- Portable spectral measurement instruments for detailed analysis of our security pigments
- Smartphone-based test equipment for mobile on-site testing
- Stationary spectral measurement equipment for calibrating security features
- In-line detectors for automated incoming checks in production processes
- Sensors for use in banknote processing machines



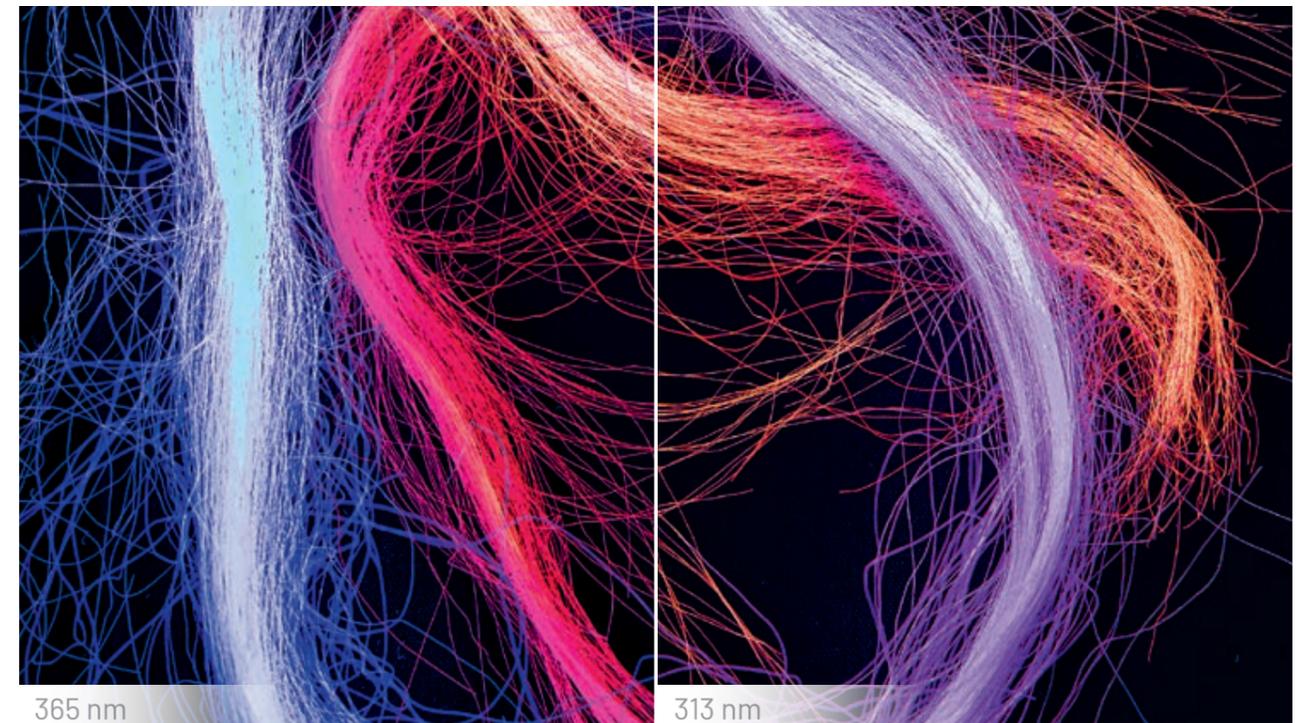


Various luminescent effects for different excitation wavelengths

VIS luminescence with UV excitation continues to be a standard solution in security applications of all types. Our extensive expertise and broad product range allow for individually configured, visible fluorescence to meet all security printing requirements. Even sophisticated metameric light effects can be achieved.

UV-VIS luminescence pigments at a glance:

- Level 2 features
- Versatile combinations with other security features possible
- Emission spectra can be differentiated
- Different excitation wavelengths possible

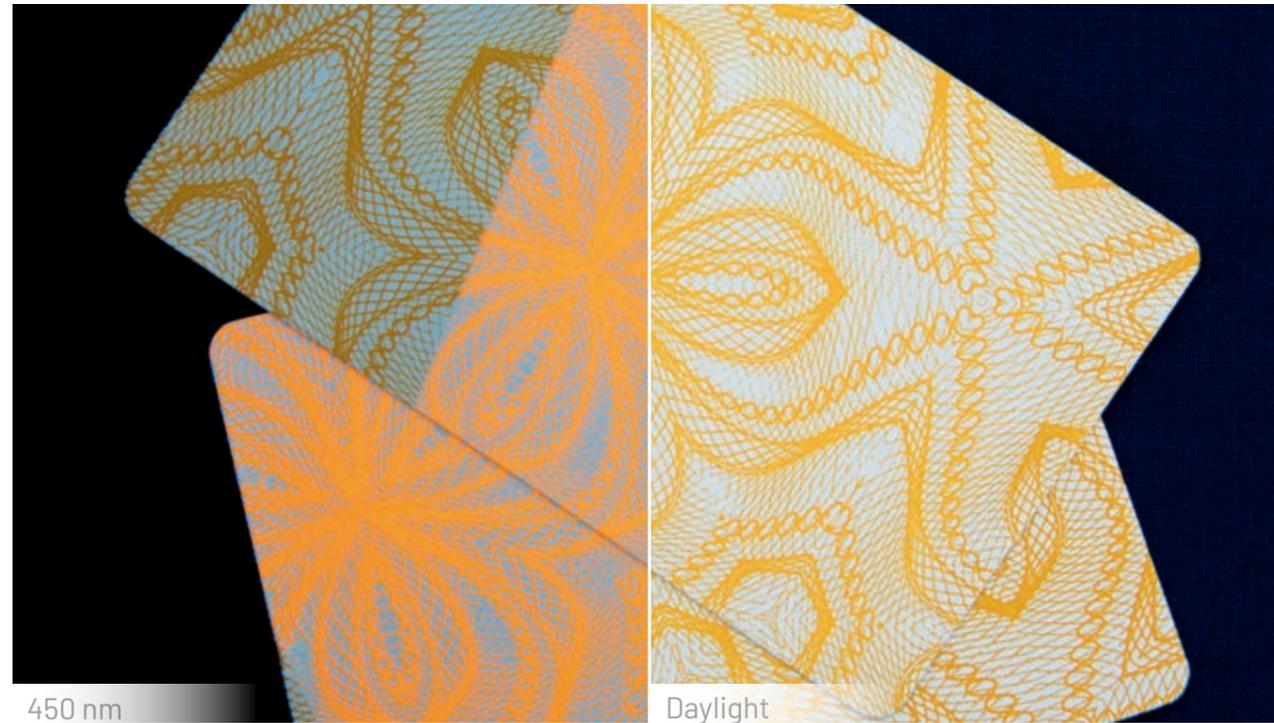


Cellulose fibres with incorporated UV-VIS luminescence for different methods of excitation

UV-VIS luminescence pigments incorporated in fibres make encoding possible in sensitive applications, such as integrating security threads in documents. These fibres are likewise suitable for product identification.

UV-VIS luminescence pigments in fibres at a glance:

- Level 2 features
- Product identification, e.g. using woven filter media
- Direct incorporation in carrier materials such as pulp

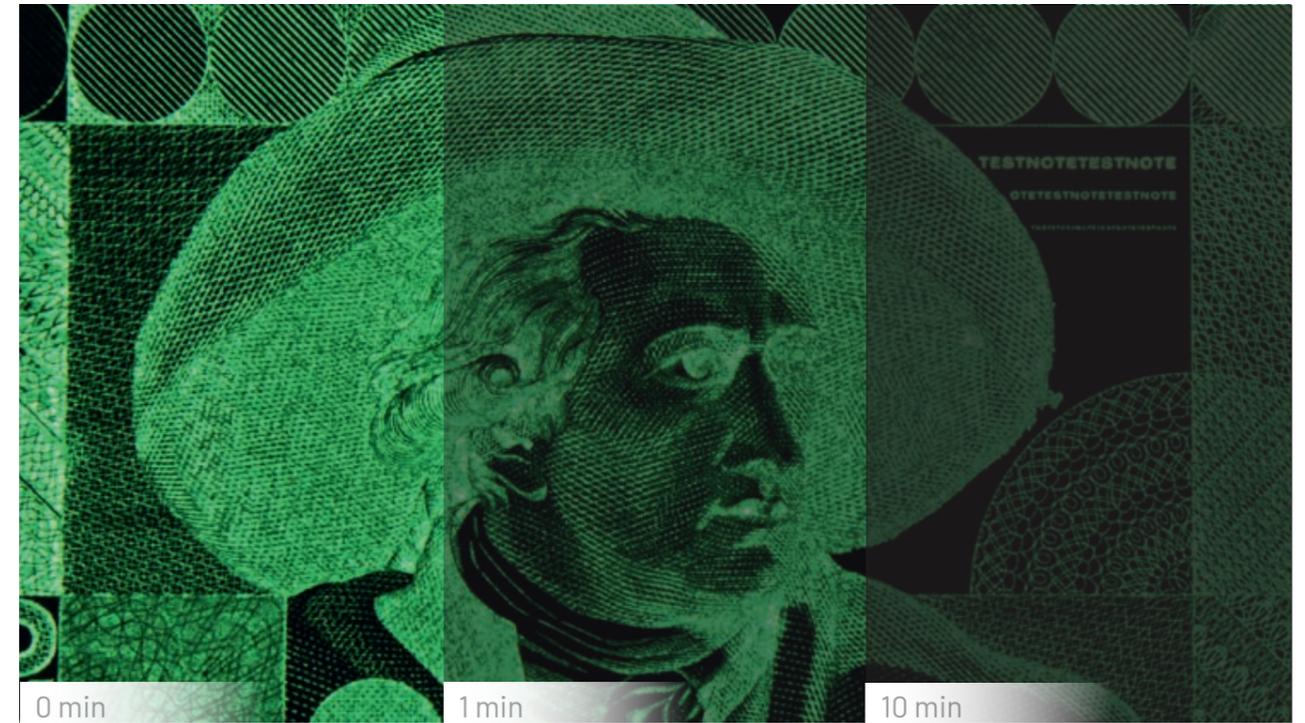


Comparison of hidden printed VIS luminescence

VIS luminescence with VIS excitation, such as with blue light, can be easily hidden in colour prints or substrates. The possibilities for evaluating the signals open up a wide range of security applications.

### VIS-VIS luminescence pigments at a glance:

- Level 2 features
- Copy protection thanks to metamerism effects
- Can be made visible using simple tools (mobile phone display)

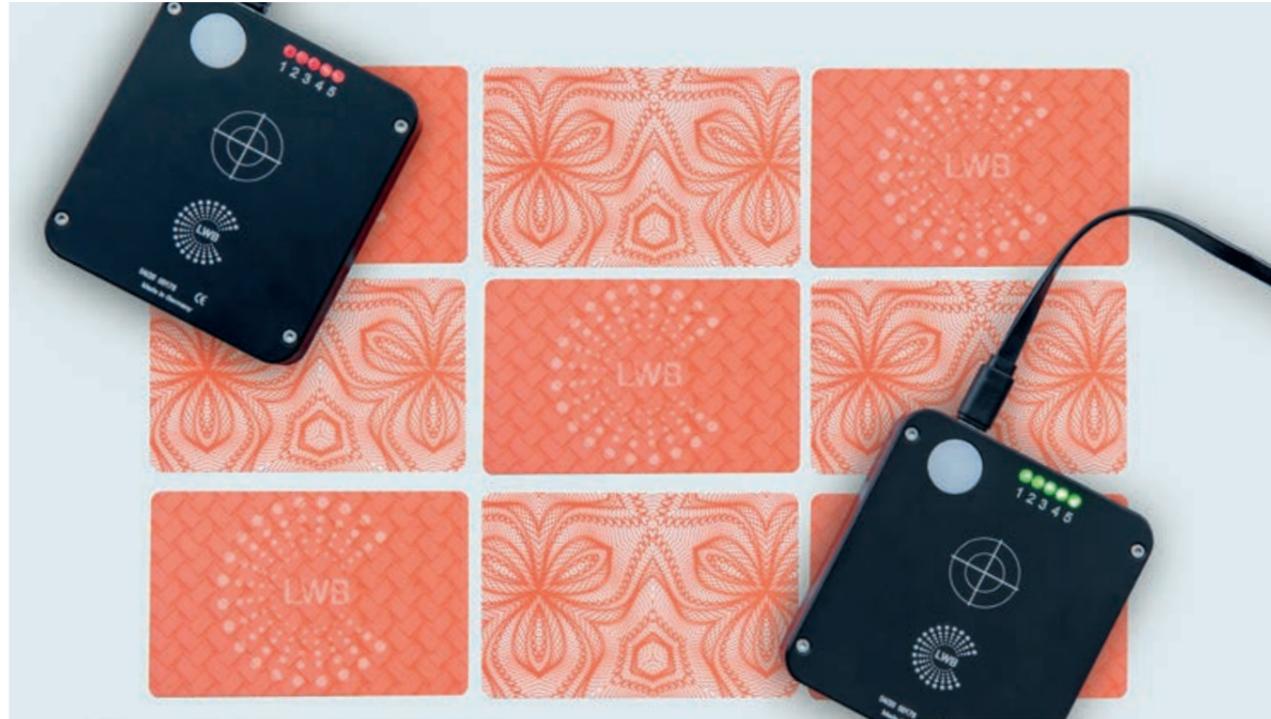


Deactivation of phosphorescence

Phosphorescence pigments are characterised by their excitability under visible light, different emission colours and different deactivation times. Beyond just the familiar use of their after glow effect, these pigments make excellent optically identifiable components for security applications.

### Phosphorescence pigments at a glance:

- Quick and easy detection (level 1)
- Can be combined with additional security features
- Metrological verification possible

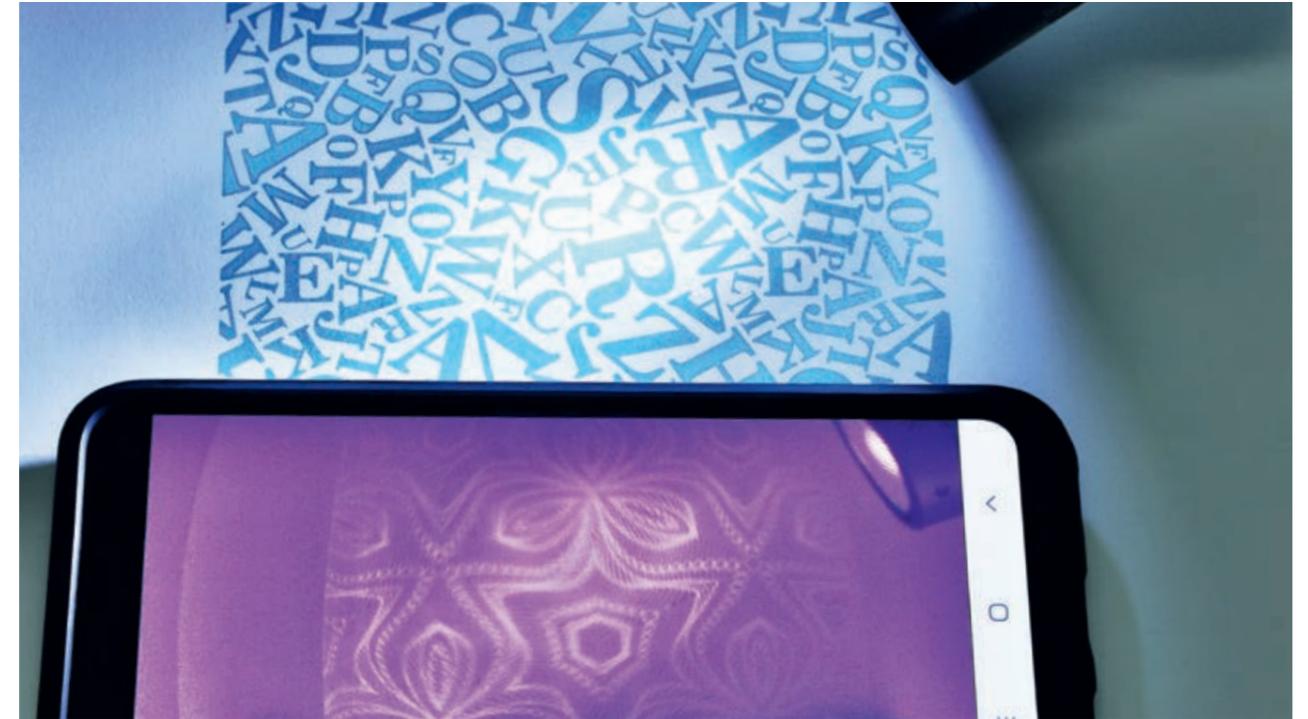


*Metrological detection of IR emission*

IR luminescence with IR excitation is characterised by its high security level, because it is invisible to the human eye. The required metrological analysis is achieved with our different detection systems.

### IR-IR luminescence pigments at a glance:

- Sophisticated level 2 features
- Very low marker concentrations possible
- No effect on the printed image
- Can be printed using offset and many other methods



*IR emission can be detected on the camera screen*

IR luminescence with VIS excitation can be easily hidden in colour prints or substrates. LWB's innovative development along with signal analysis possibilities open up a wide range of new security applications.

### VIS-IR luminescence pigments at a glance:

- Level 2 features
- Very high luminance
- Different excitation wavelengths possible
- Emission spectra can be differentiated



*Excitation of hidden IR-VIS converter pigments with IR laser at 940 nm*

The up-converters, also known as anti-Stokes pigments, can be used as hidden security features in a wide range of applications, from optical detection using simple tools to metrological detection using the smallest amount of material.

**IR-VIS converters at a glance:**

- Level 2 features
- Different fluorescent colours available
- Can be detected using simple tools
- Can be encrypted using complex test equipment



*IR absorption can be detected on the camera screen*

Visible and invisible infrared metamerism is a speciality in the field of security printing. We offer special white IR absorber pigments, which allow even light hues to be used as metameric inks.

**IR absorbers at a glance:**

- Level 2 features
- Transparent pigments allow for brilliant shades
- Very easily processed for screen and intaglio printing
- Absorption optimised for IR use
- Fine particles < 1 µm possible

**VIS-IR luminescence**  
 detection systems product identification  
**phosphorescence pigments** innovation bi-luminescence  
**security pigments**  
 copy protection Code of Conduct  
 highest quality 99.99%  
 counterfeit protection  
 customer specific  
 tri-luminescence  
 tradition  
**UV-VIS luminescence** high-tech  
 environment document printing customer proximity product validation  
**VIS-VIS converters** IR-IR luminescence  
 synergies banknotes Treibacher Industrie AG  
**IR absorbers**  
 high-security applications  
 luminescence  
 Made in Breitung  
 process control  
**IR-VIS converters**  
 after glow luminescence pigments



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