CYNORA

TADF. Next-Generation OLEDs.

www.cynora.com

About CYNORA

CYNORA is a **leading company in the development of highly efficient OLED emitting materials** for OLED displays. The company is headquartered in Bruchsal, Southern Germany. Since its founding in 2008, CYNORA's mission has been to create value for the OLED device makers with products that allow for the highest energy efficiency. With its dynamic and international team of more than 120 experts, CYNORA is highly focused on meeting customers' requirements and providing tailored emitting materials for OLED manufacturers.

CYNORA has a very efficient way of developing new OLED materials and the company's know-how is protected by **more than 600 patents** (granted and filed). As a material provider, CYNORA works closely with OLED manufacturers. The company has joint development agreements with key display panel makers including LG Display and Samsung, both of which are also strategic investors at CYNORA.

Worldwide cooperation with universities and industry associations allow us to create a strong network of competence for OLED technology. CYNORA's high-performance materials are developed and produced in accordance with the highest quality standards. The company is ISO 9001:2015 certified and a member of EFQM.

Strategic investors:

LG Display

SAMSUNG

Why OLEDs?

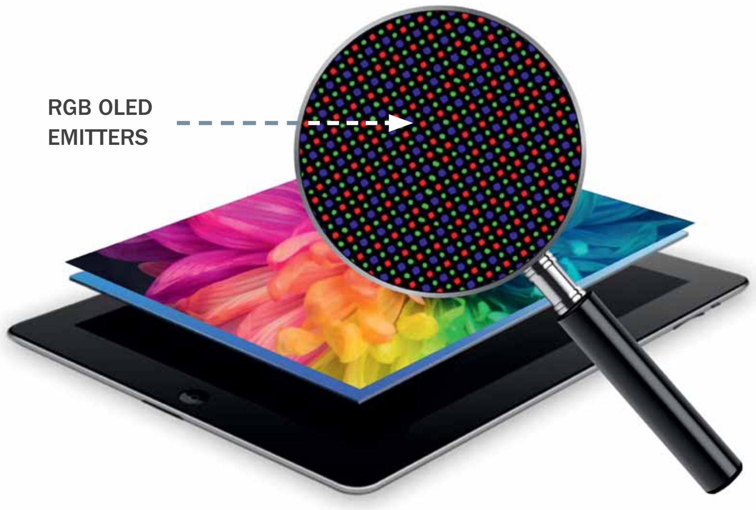
OLEDs (Organic Light-Emitting Diodes) consist of a multilayer structure of organic materials between two electrodes. Modern OLED displays are based on an array of small pixels with red, green and blue color (RGB) in the case of smartphones, and an additional white pixel (RGBW) in the case of OLED TVs. As these pixels are self-illuminating, they do not require a backlight unit like the LCD technology. Therefore, OLED panels have a much simpler structure, resulting in thinner display panels.

In contrast to the widespread LCD technology, OLED displays also have many further advantages: they feature a low power consumption, a high contrast and a wide viewing angle. Of particular interest is the use of OLED displays on transparent and flexible surfaces, which enable completely new product designs. The first foldable smartphones, like the Samsung Galaxy Fold, were enabled by the OLED technology.

OLED technology can also be used for lighting applications. Thanks to the OLED technology, these luminous panels can emit a pleasant, two-dimensional, homogeneous light. In addition, as in the case of the OLED displays, they can be transparent or flexible, and allow new integration options into the architecture or into lamps due to their low volume and weight. This makes it possible not only to design lighting products in a completely new way, but to create new lighting concepts for the design of interior or exterior facades.

Emitter: the heart of the OLED

The heart of the OLEDs are the so-called emitters. They convert electrical energy into visible light, which leads to the perception of red, green or blue pixels.



To date, three different technological concepts can be used to generate light: fluorescence, phosphorescence and thermally activated delayed fluorescence (TADF).

The main differences between these concepts can be explained through quantum mechanics. In an OLED, the electrical current leads to an excitation of the molecules and thereby to the creation of singlet and triplet excitons. The energies of the singlet exciton are higher than those of the triplet excitons, but for every singlet exciton, three triplet excitons are generated.

The first generation of emitters, the fluorescent emitters could only convert the singlet excitons and therefore only 25 % of all excitons into light. Triplet emitters (phosphorescent and TADF emitters) on the other hand, can convert up to 100 % of the excitation energy into light by using both, the singlet and the triplet excited states.

Why is efficient blue mandatory?

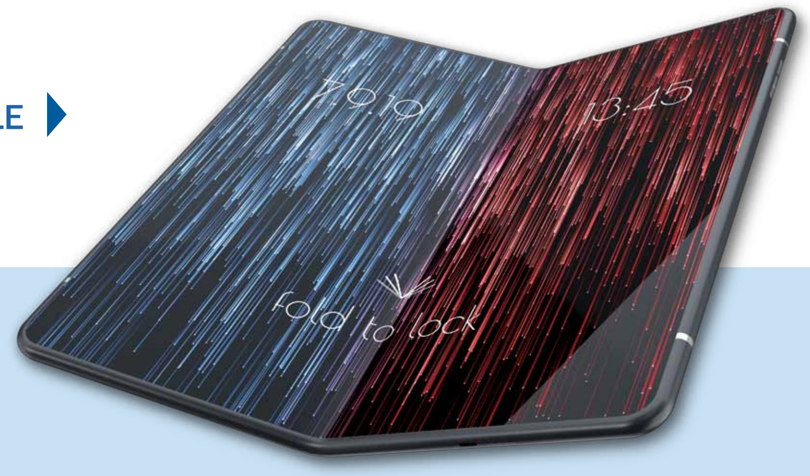
Due to the lower efficiency of the fluorescent blue emitters, which are used in current OLED products, today´s OLED displays all waste approximately 50% of the power. This higher power consumption of the inefficient fluorescent emitters is especially a problem for mobile devices that rely on battery power. A short battery lifetime is already the consumer´s biggest complaint for handheld devices. With the introduction of foldable mobile devices, the power consumption of the display is becoming an even bigger problem since the displays of these products are larger.

In addition to the high power consumption, the inefficient fluorescent emitters require a relatively large blue pixel area to reach sufficient brightness. In today´s OLED smartphones, which contain red, green, and blue pixels, the blue pixel is the biggest of all of them and it therefore limits the resolution.

High-efficiency blue emitters will enable a significant reduction of the overall display power consumption and a higher display resolution. Hence, it is no surprise that such a highly efficient blue is the most requested material by OLED display makers. And while the efficiency of green and red pixels was increased significantly with the phosphorescent technology, the same technology has not been able to deliver highly efficient blue emitters despite more than 20 years of development.

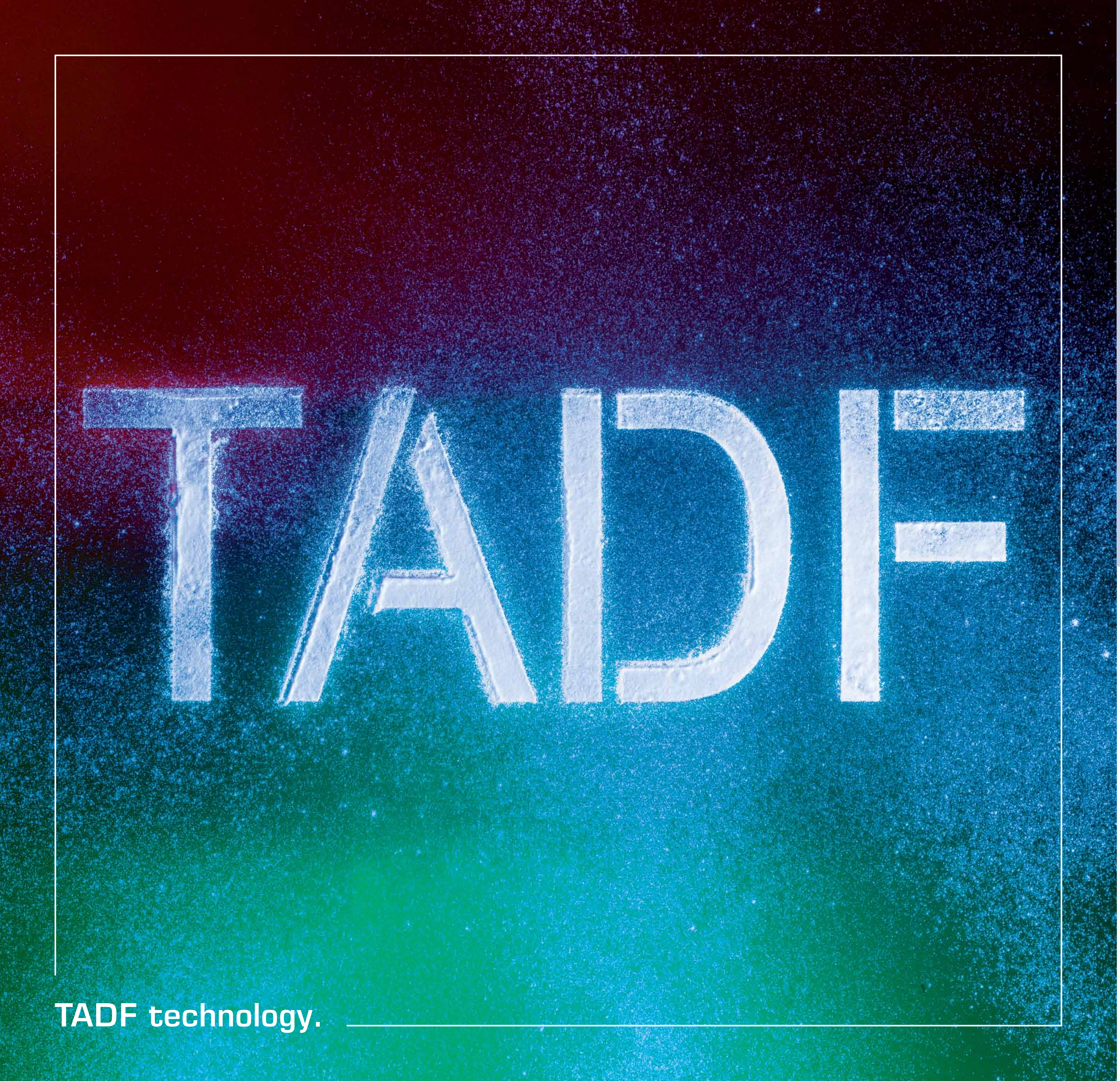
Therefore, a new technology is required: TADF (thermally activated delayed fluorescence).

FOLDABLE ▶



Low efficiency blue
▼
High power consumption
▼
Short battery lifetime

Foldable devices will allow bigger display
▼
Bigger display with slim design: less place for battery
▼
Power saving even more mandatory



TADF technology.

TADF Technology

CYNORA´s highly efficient OLED materials are based on TADF (thermally activated delayed fluorescence) technology. These materials are designed to convert up to 100% of the electrical power in an OLED to light. Therefore, our TADF materials enable us to provide efficient emitters, which allow a significant reduction of the power consumption for OLED devices.

From a molecular point of view, TADF emitters use a similar chemistry as fluorescent materials. They are fully based on organic chemistry and they do not contain any metal atoms. Thus, TADF can combine the advantages of phosphorescence (high efficiency) and fluorescence (long lifetime). This makes TADF emitters ideally suited for an efficient and stable blue emitter technology. For best performance, TADF requires an integrated system of emitter, host and transport materials, which we develop directly with our customers and partners.

Reduced power consumption and longer battery operation

Compatible with the current production processes

Adaptable for printing technology

Metal-free materials

TADF. Next-Generation OLEDs.

CYNORA

+ 49 7251 919 670
info@cynora.com
www.cynora.com

cynora GmbH
Werner-von-Siemens-Strasse 2-6 • Building 5111
76646 Bruchsal • Germany