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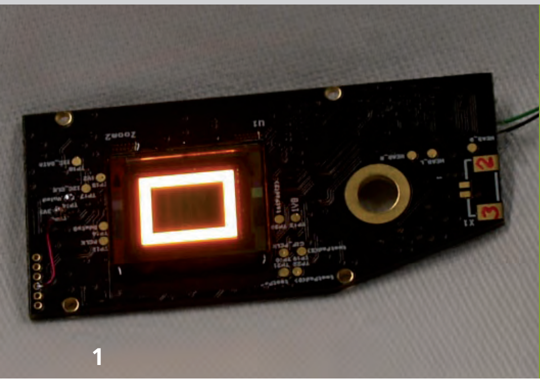

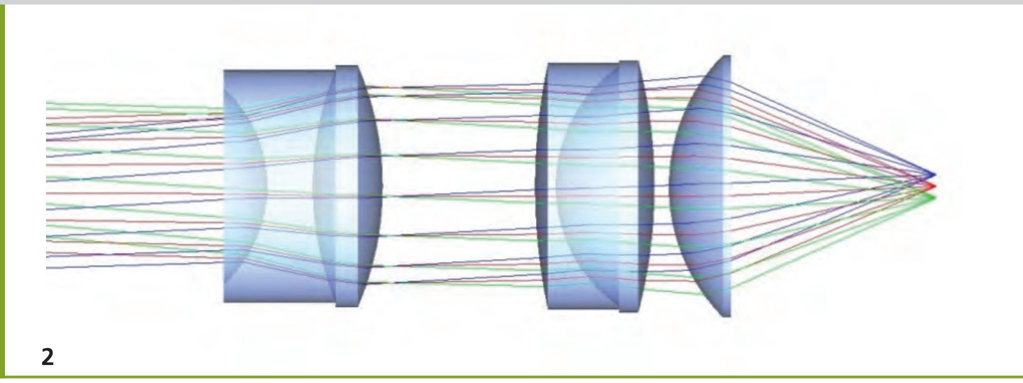

1 *Bidirectional OLED microdisplay on printed-circuit board*
2 *Lens design of the projection and imaging lens*

POSITION AND INCLINATION SENSOR

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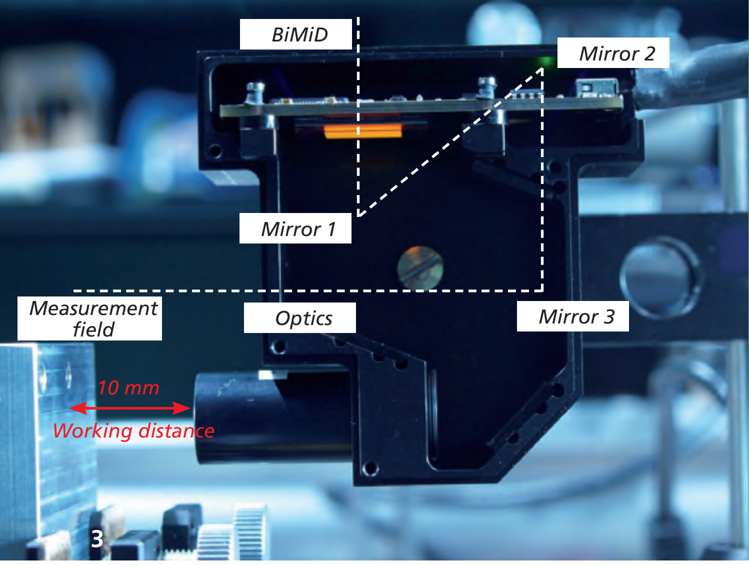
Several optical metrology systems are based on a separated camera and projection unit, which is a limitation concerning the miniaturization of the sensor.

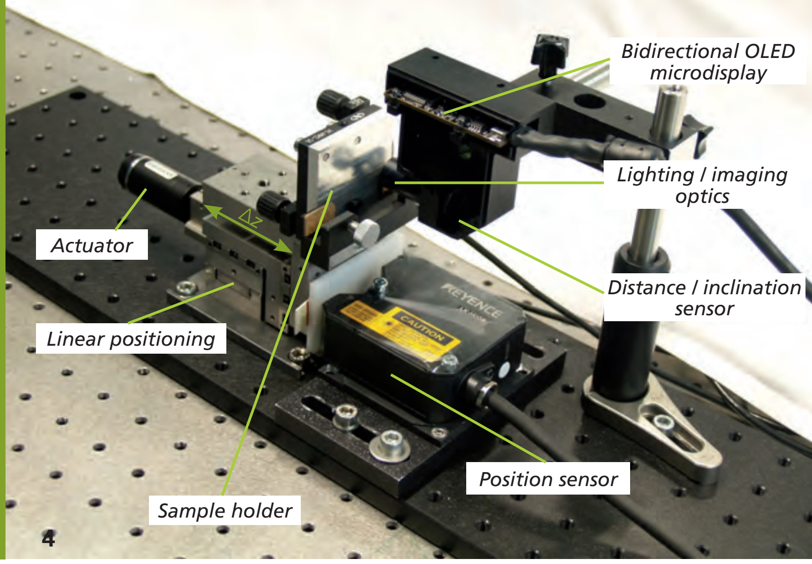
A compact, highly integrated optical distance and inclination sensor applying the inverse confocal principle using a bidirectional OLED-microdisplay. This microdisplay combines light emitting devices (OLED) and light detectors (photo diodes) on one single chip based on OLED-on-CMOS technology. This new opto-electrical device reduces number of system components, lower installation volume and weight of the optical metrology system. Due to this effect an easy integration in encapsulated machines is possible.

According to conventional confocal sensors, the object is shifted through the focal plane (±Δz) and the back-scattered light is collected via the special designed optics and detected by the photo diodes. The detected photocurrent depends on Δz. In contrary to conventional confocal sensors, the novel inverse confocal sensor detects a minimum of back-scattered light if the object is positioned in the focal plane.

Ultra compact surface metrology system

- Only one opto-electrical device
- Easy integration in encapsulated processing machines
- Only one optical element: the projection lens is also the imaging lens





OLED-on-CMOS Bidirectional Microdisplay

To achieve high-performance OLED characteristics on a standard CMOS process a modification of the top metal layer is necessary. The common requirements of an OLED compatible top metal layer are high reflectivity in the visible range of light, a smooth surface to prevent shorts in the OLED stack, and avoiding oxidation. A top emitting p-i-n OLED has a reflective bottom electrode and a transparent top electrode. Between these electrodes there is an OLED stack with doped transport layers and a triplet emitter system to realize a highly efficient and low voltage light emitter. Fig. 5 shows the principle of OLED pixel and photodiode co-integration.

The modified top-metal layer is used as bottom electrode and defines the shape and size of an OLED pixel. Below the bottom electrode there is space to integrate drive circuitry. The photo detector device is realized by a n-well diffusion in a p-substrate. By using this structure you can realize a light emitting and a photo detecting device with integrated driving circuits on a single CMOS chip.

Application BiMiD

- Surface metrology system based on bidirectional microdisplay
- Position and inclination sensor

Principle

- Inverse-confocal microscope

Technical Parameters

Surface metrology system

- Positions accuracy: < ±1 µm
- Working distance: 10 mm
- Measuring field diagonal: 1.12 mm
- Spatial frequency: 68 lp / mm
- System magnification: 1 / 13
- Monochrome wavelength range
- Lens installation lens: 22.5 mm
- Lens diameter (including mounting): 14 mm

Bidirectional Microdisplay

- Brightness: < 5.000 cd / m²
- Display resolution: 320 × 240 pixels (QVGA) monochrome
- Camera resolution: 160 × 120 photodiodes
- Active matrix diagonal size: 14.3 mm (ca. 0.6”)

References:

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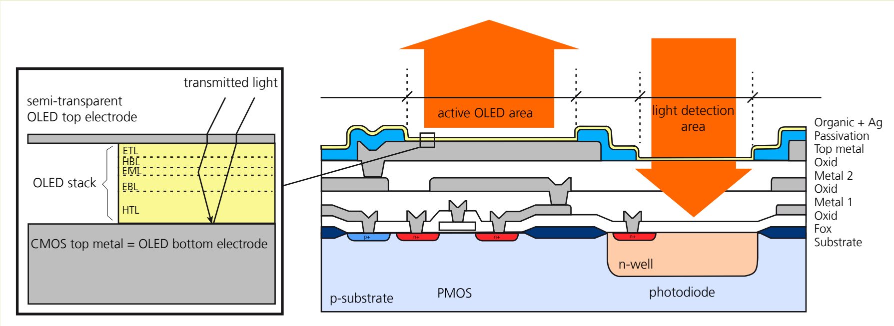
5 OLED pixel and photodiode co-integration



3 Prototype of the optical head of the position and inclination sensor

4 Mechanical setup of the position and inclination sensor

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