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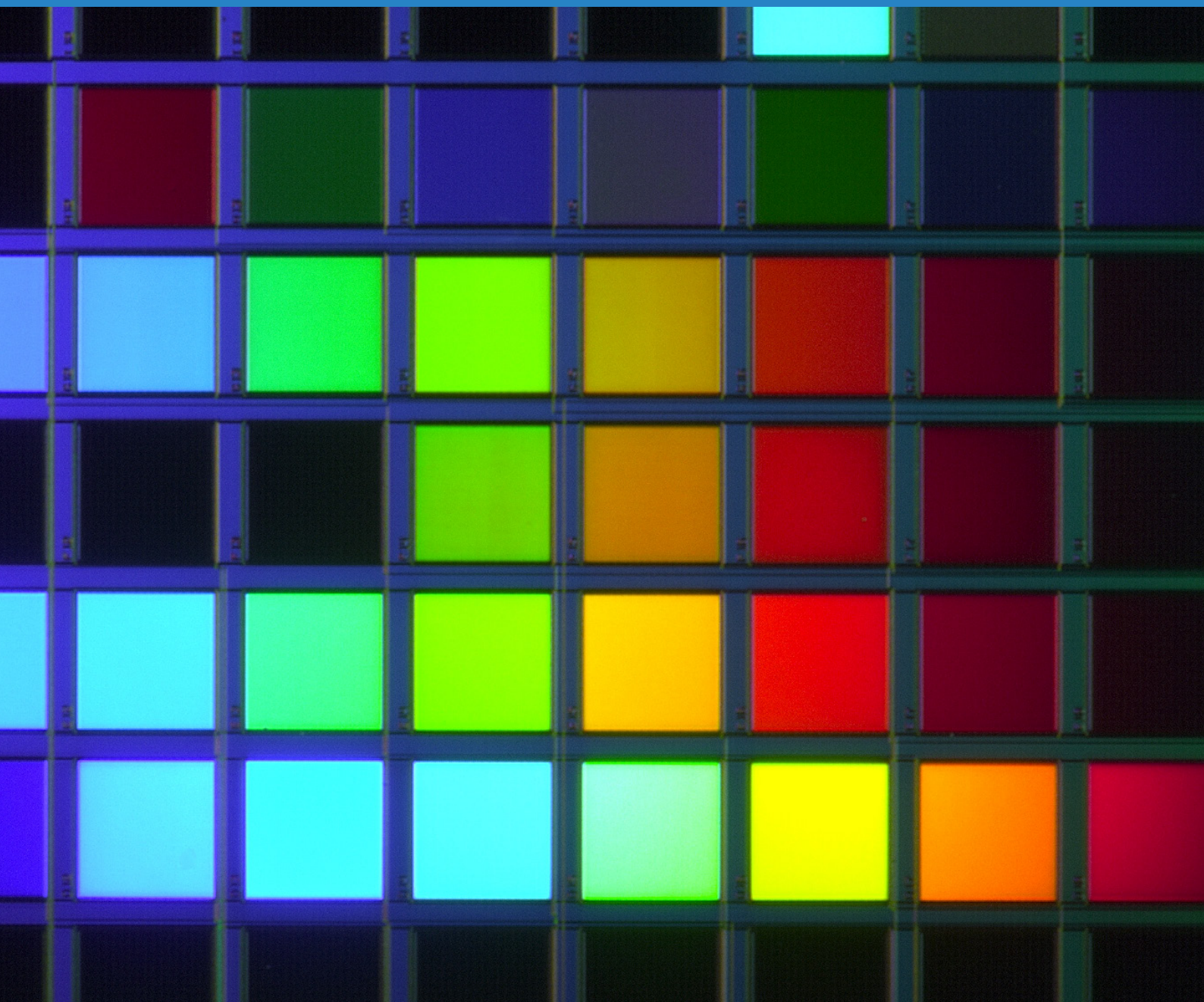
NANOSTRUCTURED COLOUR AND POLARISATION SENSORS IN CMOS-TECHNOLOGY

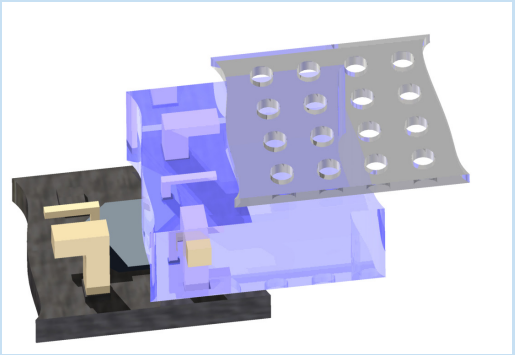


OVERVIEW

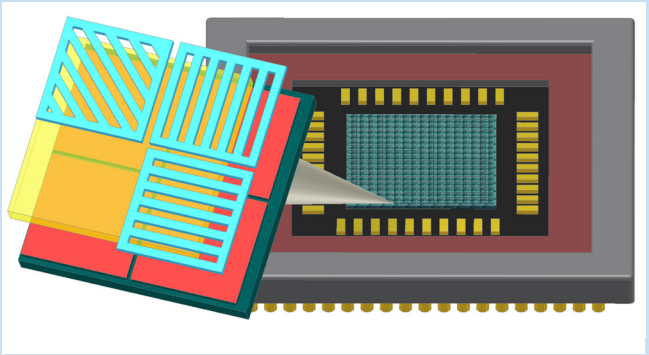
Our institute has comprehensive experience in design of embedded photosensors. To find an economic solution for every assignment, we focus on the use of cost-effective standard CMOS-technology. By structuring the metal planes of a CMOS process, colour and polarisation sensors can be designed with almost arbitrary filter functions.

TECHNOLOGY

In modern CMOS processes with gate-lengths of 180 nm or below, the metal planes normally used for interconnections can be etched with feature sizes smaller than the wavelength of visible light. These so-called "Subwavelength-Structures" show a unique transmission behaviour for optical waves. By proper design of the structures with gratings or holes in one or more metal layers, optical functionality can be achieved.



Sensor architecture with nano-structured metal planes, isolating dielectrics and photodiode



Scheme of polarisation-imager with polarisation-sensitive sub-pixels

MEASURED SPECTRAL SENSITIVITY AND TRANSMISSION OF COLOUR AND POLARISATION SENSORS

APPLICATIONS

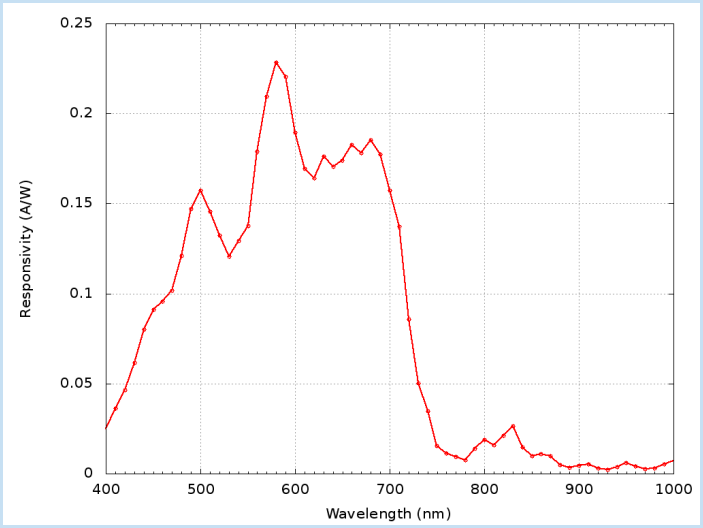
Possible applications of spectral sensors are including:

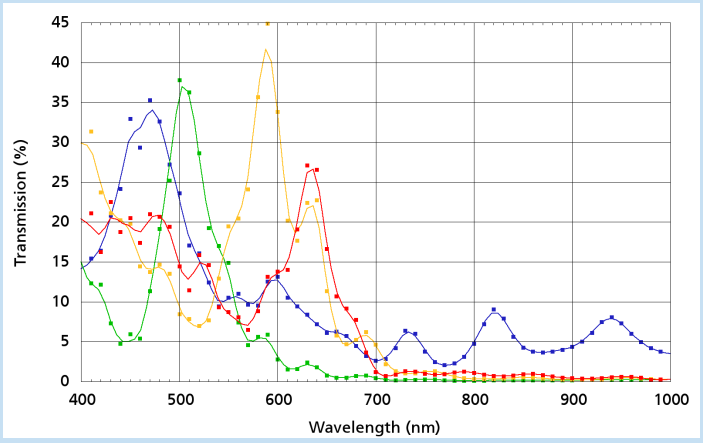
- Control of LEDs in many lighting situations, e.g. in LCD-Backlights
- Application specific colour sensors for industrial automation with almost arbitrary spectral function
- Colour sensors under high temperature or humidity conditions, e.g. in cars
- Miniaturized multi-spectral sensors for analytics of gases and fluids
- Miniaturized perceptive sensors without the need of additional filter layers

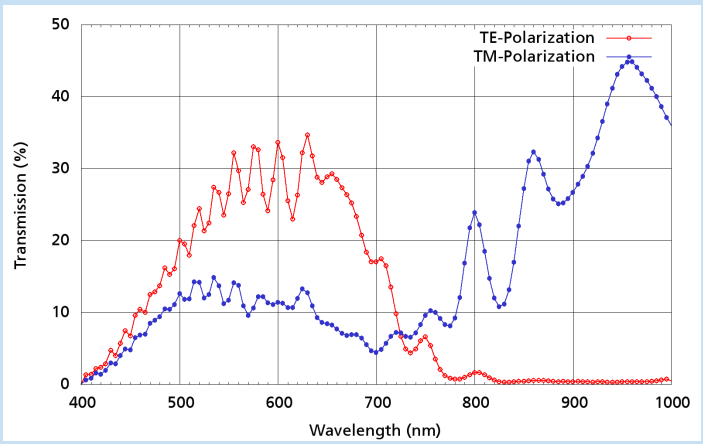
New Polarisation sensors could be applied in:

- High resolution polarimeters without moving parts for chemical analytics
- Polarisation cameras in quality monitoring, e.g. for monitoring of fabrication process
- Polarisation cameras with increased contrast ratio for inspection of metallic surfaces
- Polarisation cameras for medical diagnostics, e.g. for cell-monitoring
- Ellipsometers for measuring layer thicknesses
- Road surveillance cameras with switchable polarisation for suppression of reflections

Moreover, pixelwise polarization sensing is possible within a standard CMOS technology. A polarization camera is available using state-of-the-art imagers.







Examples for filter transmission performances
a) IR blocking filter, b) Various bandpass filters,
c) Polarisation sensitive filter

06/2012 K. Brohasga

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Fraunhofer Institute for
Integrated Circuits IIS

Director
Prof. Dr.-Ing. Albert Heuberger

Am Wolfsmantel 33
91058 Erlangen, Germany

Contact
Dr.-Ing. Norbert Weber
Phone +49 9131 776-9210
Fax +49 9131 776-4499
norbert.weber@iis.fraunhofer.de