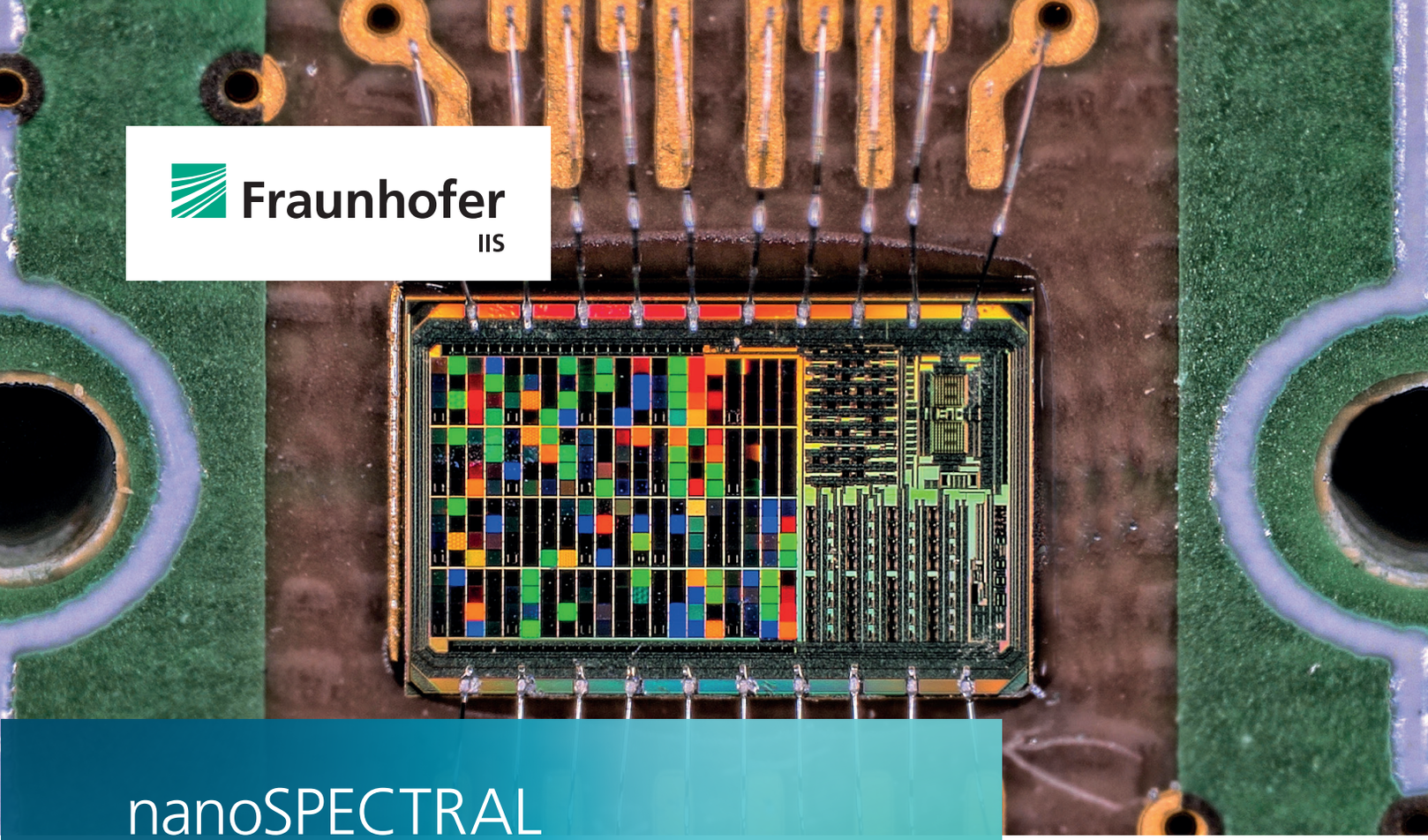


Fraunhofer IIS

nanoSPECTRAL Color Filters in CMOS

Multispectral and polarization sensors

Chip-size spectrometer
© Fraunhofer IIS

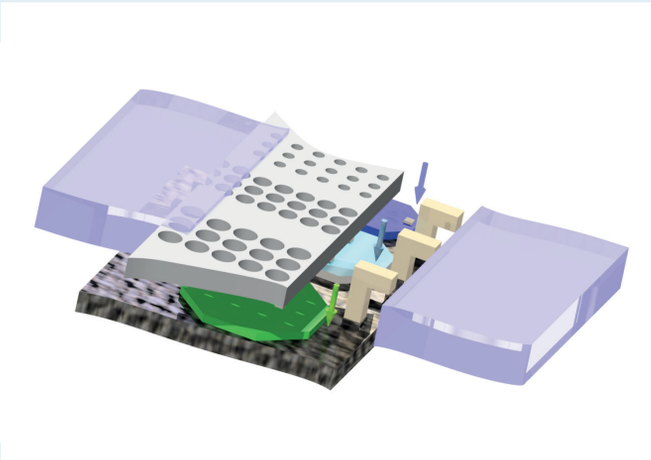
Our nanoSPECTRAL technology enables highly integrated sensors with many spectral channels at minimal cost – regardless of the number of channels. The structuring of metal layers in the CMOS process eliminates the need for additional steps as with conventional filters. The result: cost-efficient and high-performance sensors that are immediately available in industrial quality.

Features

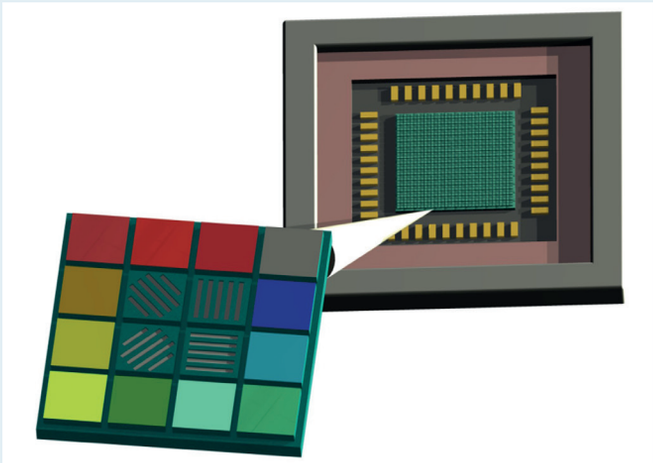
- Realization of many spectral channels on one chip with direct fabrication in the CMOS semiconductor process
- Optical nanostructures in thin metal layers
- Design of specific spectral behaviors
- Can also be applied to existing single or image sensors
- Integrated signal processing and standard interface such as SPI
- Numbers of spectral channels: up to 1000 according to customer requirement
- Bandpass filters from 400-1000 nm
- Measured transmission up to 40 %
- Full widths at half maximum (FWHM) from 25-50 nm
- Filter wavelength, transmission, and bandwidth can be tailored

Benefits

- Single-source production
- Consistently low process costs with almost any number of spectral channels
- High temperature resistance
- Application-specific filter properties
- Easy implementation in standard products
- Independent service design and supply chains
- Fast series transfer



Schematic drawing of the substrate, photodiodes and plasmonic filter structure. © Fraunhofer IIS



Multispectral combined with polarization: 12 spectral and 4 polarization channels. © Fraunhofer IIS

Technology Potential

Low-cost chip-size spectrometer

- Compact design with integrated spectral filters, enabling comprehensive spectral analysis in a small footprint
- Point measurement with high spectral resolution
- High sensitivity and accuracy in capturing spectral data, ideal for portable applications
- Flexible customization options for various wavelength ranges, covering a wide range of applications

Low-cost multispectral imaging

- Image sensors with spectral filters applied at pixel level
- Spatially resolved measurements with average spectral analysis
- Application of filters to established standard products or new image sensor designs
- Minimum pixel size: 5 µm

Applications

- Smart farming in agriculture
- Analysis of gases by measuring color changes
- Analysis of liquids by spectral absorption measurement
- Food analysis by measuring reflectance spectra
- Medical applications at the point of care
- Color control for LED lighting systems
- Analysis of moisture, ingredients and irritants in hygiene products
- Applications in cosmetics

Our offer: Cost-effective realization of many spectral channels

We leverage our expertise in surface plasmon effects and optical nanostructures in CMOS materials to develop filters and provide tailored solutions throughout the development process for your specific applications:

- Simulation of optical nanostructures with spectral filter effect and with effect as polarization filters
- Design of photodiode arrays and image sensors
- Production run of integrated sensors
- Electrical and optical characterization
- System design for numerous applications

Contact

Dr. rer. nat. Stephan Junger
Phone: +49 9131 776-9215
sensorsysteme@iis.fraunhofer.de

Fraunhofer IIS
Am Wolfsmantel 33
91058 Erlangen

www.iis.fraunhofer.de/nanospectral