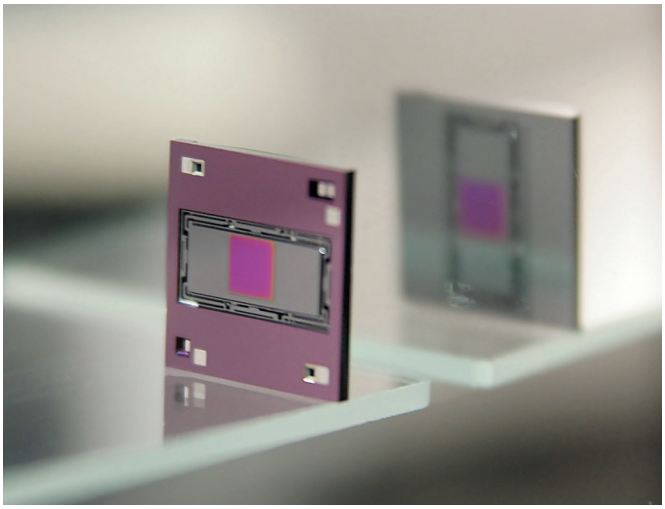
Fraunhofer ENAS

Systems

Miniaturized Tunable Band-Pass Filters for the Infrared Spectral Range

Fast Facts

- Small size 7 x 7 mm² and small thickness < 1.5 mm
- Aperture Ø 2 mm, larger aperture possible
- Spectral range: 3 – 5 µm, 5 – 8 µm, 8 – 11 µm
- Transmission > 70 %
- Selectivity (FWHM) 25 – 200 nm
- Time constant 2 – 20 ms

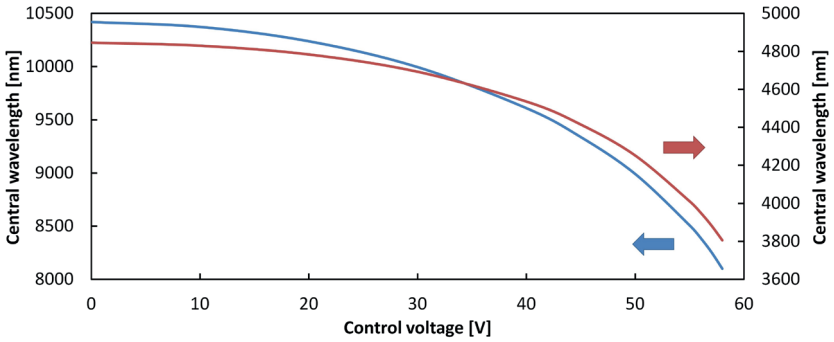


General Description

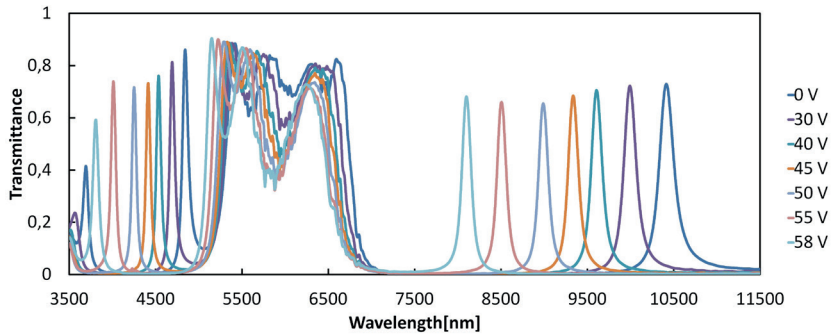
Electrically tunable band-pass filters for the infrared spectral range are suitable for many spectral analysis based devices in medical, industrial and safety applications, e.g. determination of gas concentrations or spectral imaging. Fraunhofer ENAS developed in cooperation with the Center for Microtechnologies of Chemnitz University of Technology and InfraTec GmbH miniaturized filters for the spectral range from 3 µm to 11 µm. In a silicon wafer batch process the filters are fabricated very cost-efficient. The full width at half maximum (FWHM) bandwidth of the filters is 50 nm to 200 nm and depends on the interference order used. The passband can be tuned electrically in a defined spectral range (e.g. 11 µm to 8 µm) and has a maximum transmittance of more than 70 percent. The filters are made of two equal and movable reflector carriers, which minimize the influence of vibration and gravitation induced forces on the reflector spacing and hence the central wavelength of the passband. The tunable infrared filters are based on the Fabry-Pérot interferometer and are designed and fabricated as MOEMS (micro-opto-electro-mechanical system) with chip dimensions of 8.5 mm x 8.5 mm x 0.6 mm (width x length x height).

Suggested Applications

- Analysis of liquids (e.g. determination of solvents)
- Analysis of gases (e.g. determination of concentration)
- Spectral imaging



Measured transmittance spectra of a dual-band Fabry-Pérot interferometer for different control voltages. The wavelength ranges from 4 µm to 5 µm and from 8 µm to 10.5 µm can be used simultaneously.



Central wavelength as a function of control voltage on the example of a dual-band Fabry-Pérot interferometer for the wavelength ranges from 4 µm to 5 µm (red curve) and from 8 µm to 10.5 µm (blue curve).

Specifications

Parameter	Value	Unit
Spectral range	3 – 5 5 – 8 8 – 11	µm
Transmittance	> 70	%
Band width (FWHM)	50 – 200	nm
Control voltage	15 – 60	V
Aperture	2 x 2	mm²
Chip size	8.5 x 8.5 x 0.6	mm³

In cooperation with

ZfM Zentrum für Mikrotechnologien

Technische Universität Chemnitz

InfraTec Infrarotsensorik und Messtechnik

Fraunhofer ENAS is part of

Forschungsfabrik Mikroelektronik Deutschland

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