

From farm to fork: Enabling portable photonics for the food industry

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12/12/2022

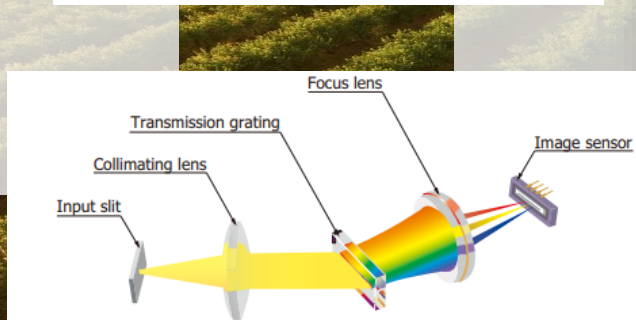
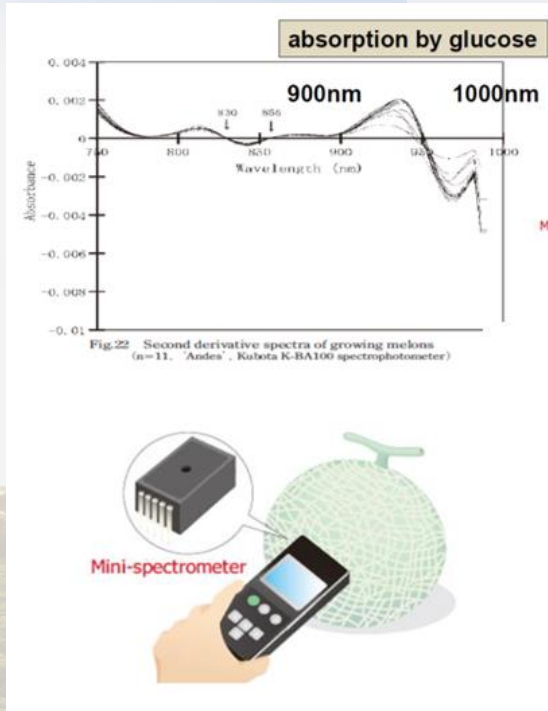
Hamamatsu Photonics: A driver in the industry



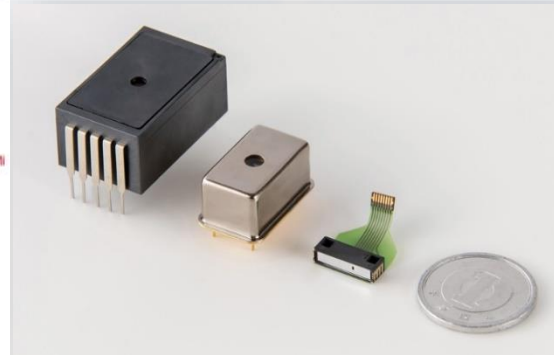
Applications

Traditional and Vertical Farming:

- Fertilizer quantity
- Soil moisture
- Produce ripeness
- Spectrum monitoring of illumination system



Spectral sensors



- VIS-NIR wavelength range: 350 – 1050 nm
- High sensitivity and wide dynamic range
- Up to 12 nm resolution
- Compact design
- No moving parts

Spectrometer modules



- UV to NIR wavelength range: 200 – 1700 nm
- High sensitivity and wide dynamic range
- Up to 0.3 nm resolution
- No moving parts
- USB powered
- Dedicated control/readout software

Photonics in Food Quality Assessment

Applications

Food content measurement:

- Moisture/Water
- Lipids
- Carbohydrates
- Protein (Gluten, Lactose)

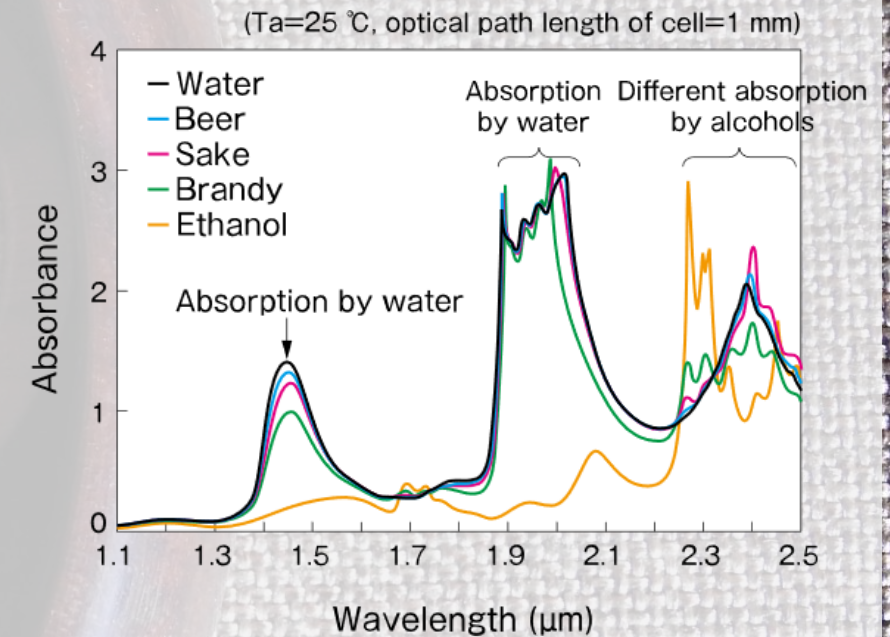
Fraud prevention:

- Olive Oil
- Wine
- Coffee
- Honey

FTIR Engine



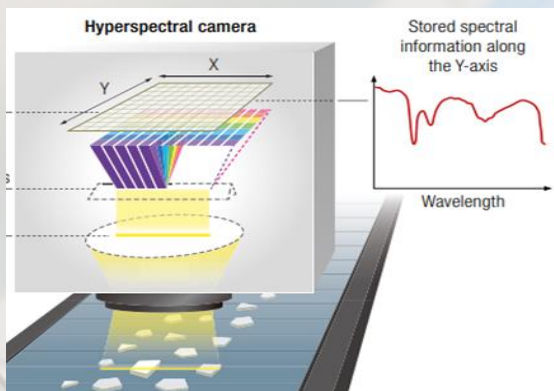
- Compact design
- Extended IR range: 1100- 2500 nm
- High SNR: 10'000
- Resolution up to 5.7 nm
- USB interface
- Fiber coupling



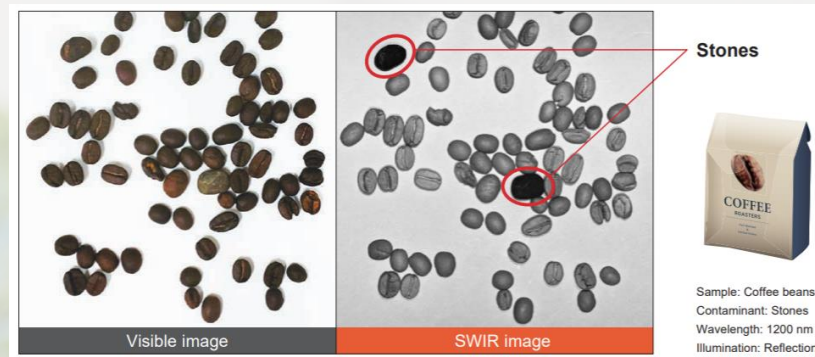
Photonics in Food Sorting

Application:

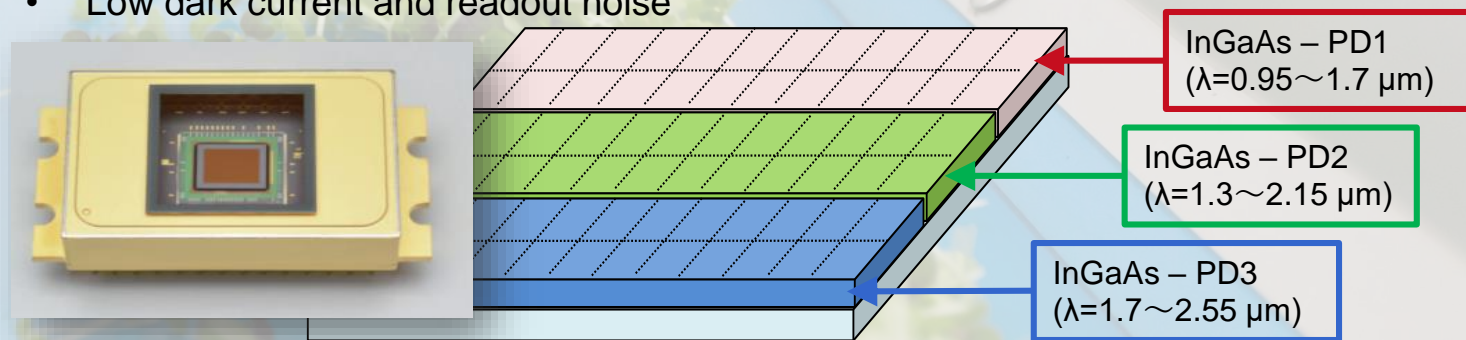
- **Hyperspectral Imaging in NIR**



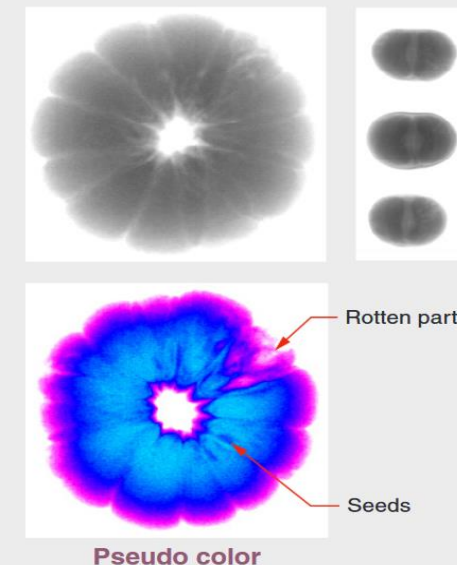
- **Identification Of Foreign Objects**
- **Food sorting**
- **Non-destructive testing**



- Line and area sensors
- Wide wavelength range: 950 – 2555 nm
- Line rate up to 40k lines/s
- Low dark current and readout noise



Customized InGaAs 2D detector



Photonics in Food Packaging

Applications:

- **Liquid level detection**
- **Packaging defect detection**

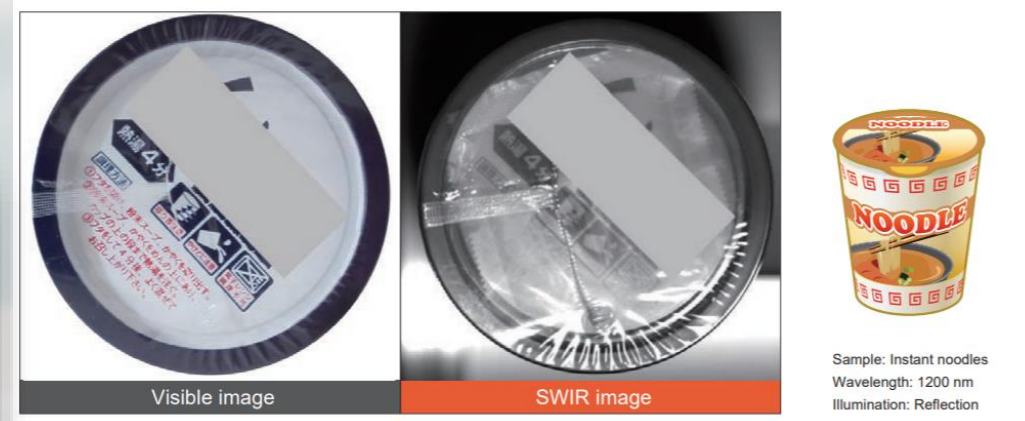
InGaAs Cameras



InGaAs line scan camera (1024 pixel array) C1533-10^E

MAIN FEATURES

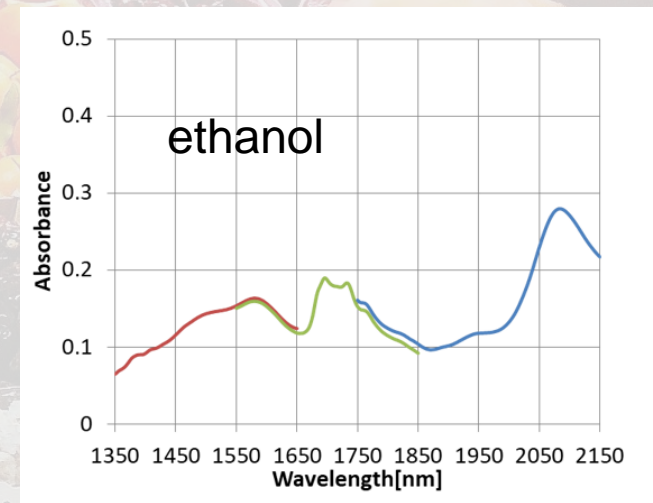
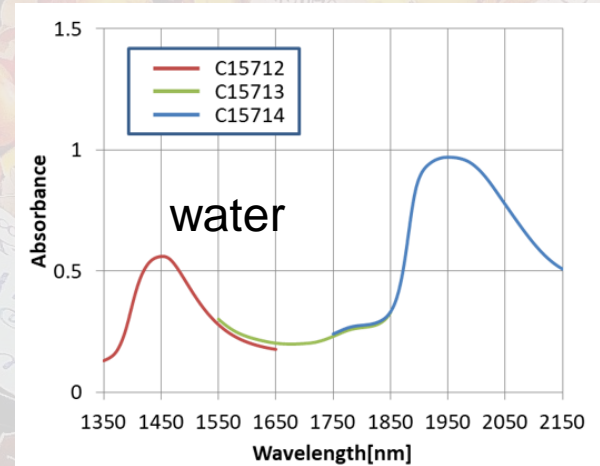
- High SWIR sensitivity: 950 -1700 nm
- Fast line rate: up to 40 KHz
- Compact design
- Calibration function



Photonics at the Grocery Store

Applications:

- **Moisture content measurement**
- **Food content measurement: lipids, carbohydrates, proteins, ethanol**
- **Produce ripeness**



MEMS Fabry-Perot Interferometer



- Compact and lightweight design (5g)
- Wavelength range: 1.35 – 2.15 μm
- Resolution up to 18 nm
- Low-cost solution
- Hermetic package

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