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Integrated narrow bandpass filters array for miniature spectrometer

Compact, lightweight, and rigid miniature spectrometers without moving parts are needed for a wide variety of applications, including space applications, where every inch of payload counts. Miniaturization increases the portability and paves the way for making *in situ* spectral measurements for daily life of food-safety and health, etc. It also eases the integration of microspectrometers and miniature spectrometers into other technologies, such as microelectronics, and helps to realize lab-on-a-chip devices. It attracts many research interests in recent years. Many novel wavelength division approaches have been proposed for miniature spectrometers, such as colloidal quantum dot spectrometer and disordered photonic chip. The optical filter array is one of the most important components in wavelength-division multiplexing, multispectral devices, and parallel array optics, which are widely used in communication and electrooptical systems. We proposed and realized the concept of integrated narrow bandpass filter array from 2004, which can totally match with detectors array with very high spectral resolution and high structure & spectrum flexibility, and resulting in simple structure and small volume with high reliability. We developed the combinatorial etching technique and combinatorial deposition technique for fabrication of such devices. We also demonstrated a concept of a high-resolution miniature spectrometer using an integrated filter array. Such a device has already been successfully used in a multi-spectral luminescence imaging for plant growth research setup of Shijian ten satellites launched in 2016.

Figure1: The photos of plant growth setup in space (left), integrated narrow bandpass filters array (INBPFA) used (middle) and spectra of each channels (right)

Biography

Shao-Wei Wang received his PhD (2003) degree in Microelectronics and Solid State Electronics from Shanghai Institute of Technical Physics, Chinese Academy of Sciences, China. He is a Professor of the institute and works at National Laboratory for Infrared Physics from 2010. His research interests include artificial photonic structure and devices, such as interaction between high-Q optical cavity and low-dimensional materials, integrated-cavities for miniature spectrometers, solar selective absorbers, meta-material polarizers, and optical thin films. He has published more than 50 research papers and authorized one US patent. He has received several which includes: Lu Jiaxi Young Talent Award (2009), Rao Yutai Basic Optical Award (2007), National Natural Science Award (2014, 4th principal achiever), National Technological Invention Award (2011, 5th principal achiever), Shanghai Technological Invention Award (2010, 7th principal achiever), Shanghai Natural Science Award (2007, 5th principal achiever), etc.

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