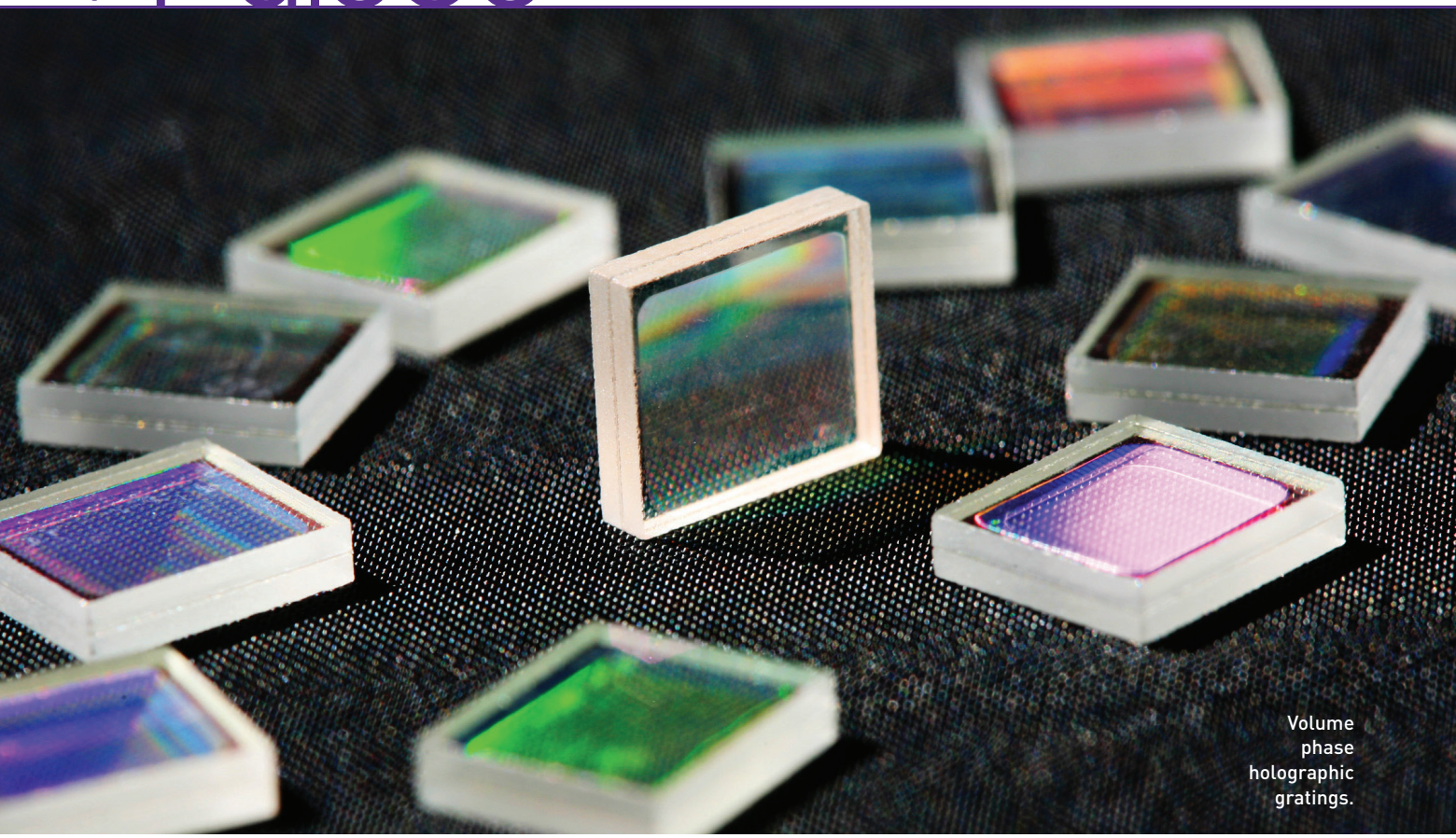

Volume phase holographic gratings.

BaySpec Inc.

OPTICS INNOVATIONS

BaySpec Inc.: We Can Make It!

Frederick Haibach

How does BaySpec's business model provide for sustainable growth? By exploring and understanding new markets and manufacturing custom solutions for clients.

BaySpec was established in the late 1990s when William Yang, was asked to build a grating-based wavelength-division multiplexer-demultiplexer. The customer, Bell Laboratories, requested a large number of channels and performance in extreme temperatures without thermal compensation. For this challenge, Yang used highly-efficient volume phase holographic gratings (VPG), but building the device to withstand harsh environmental conditions was daunting. So he brought in a trusted friend and classmate, Charlie Zhang from the University of Waterloo in Canada, to help build the prototype. After satisfying Bell Labs, they founded BaySpec Inc. Within two years the company went from its humble beginnings in a Silicon Valley garage to holding 18 patents.

Fourteen years and nearly 35,000 spectral engines later, BaySpec continues to grow. Optical telecommunications is still a priority for the company, but it has expanded into the field of spectroscopy. This diversification, in addition to custom manufacturing, has contributed greatly to BaySpec's success.

From optical telecom to spectroscopy

Competition in optical telecommunications is intense; the providers that survived the market collapse in the early 2000s have driven the cost of components down even though the volume of devices continues to increase. In this type of environment, diversification is important to maintain growth and profitability. Using their expertise

in building telecom spectral engines, which typically monitor near-infrared (NIR) wavelengths around 1,500 nm and are made with telecom reliability-tested components, BaySpec engineers entered the spectroscopy sector to create NIR spectral engines for the OEM market. The company also built lasers and light sources for its wavelength monitors.

In 2009, BaySpec, with its expertise in miniaturized, low-power-consumption and highly sensitive NIR spectral engines and lasers, developed the first handheld 1064 nm excitation wavelength Raman spectrometer. This was challenging for many reasons.

In this type of environment, diversification is important to maintain growth and profitability.

The Raman scattering process is inherently inefficient; at visible and NIR wavelengths, only about 1×10^{-7} of the incident photons are inelastically scattered. At shorter wavelengths, processes that lead to fluorescence are efficient and can overwhelm the Raman photons. Signal integration time in a handheld device is only a few seconds—any longer and hand movement begins to dominate the noise in the measurement. Also, the device must be small and lightweight, placing further restrictions on the spectral engine and power supply. BaySpec met these challenges and in 2011 Rigaku Americas acquired its Raman handheld spectrometer product line.

Innovative designs

The Rigaku acquisition freed up time for BaySpec leadership to innovate and change the landscape of spectroscopy instrumentation. One outcome is the Agility, a dual-band Raman spectrometer developed last year to meet the need for rapid and accurate molecular-composition analysis of materials in a small transportable instrument.

While fluorescence avoidance by 1,064 nm excitation is important for many real-world samples, using shorter laser excitation wavelengths allows more efficient measuring of certain materials with small Raman cross-sections. Incorporating both a long and short wavelength Raman spectrometer system into one instrument allowing users to measure nearly all materials used in the pharmaceutical industry, colored and uncolored.

The February 2014 release of the OCI series of lightweight visible and NIR hyperspectral imagers has taken BaySpec in a different direction. Multispectral and hyperspectral imagers have utility in spacecraft and aircraft for geology and large-scale agriculture applications. Spectral imaging has not made significant inroads here because of cost and complexity. A small, lightweight, handheld device with onboard computing would be ideal for smaller-scale mapping.

Low-cost unmanned aerial vehicles with hyperspectral imagers could produce detailed maps of natural and man-made disasters. Biomedical imaging is also a potential application. Hyperspectral imagers could monitor NIR contrast agents used for treating melanomas or quantitative analysis of arterial and venous vessel regrowth in third-degree burns.

Planning for future success

BaySpec has a knack for identifying new uses for Raman microscopes, spectral engines, deep-cooled cameras, spectrographs and lasers. The optical telecommunications market is unpredictable; it is limited by a small number of customers and could suddenly shrink with the invention of a new technology. Spectroscopy markets are more stable, but products have lower price tags. Maintaining a strong presence in both fields has proved the key to BaySpec's success. OPN

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COMPANY INFO

URL
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HEADQUARTERS
San Jose, Calif., U.S.A.

CEO
William Yang

VP ENGINEERING
Charlie Zhang

FOUNDED
1999

PRODUCT TYPES
Spectrum monitors, spectrometers, Raman analyzers, Raman microscopes and hyperspectral imagers

APPLICATIONS
R&D, biomedical, pharmaceuticals, chemical, food, semiconductor, homeland security and optical telecommunications