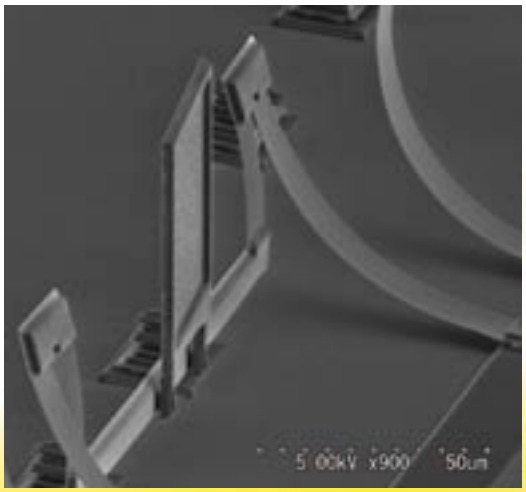
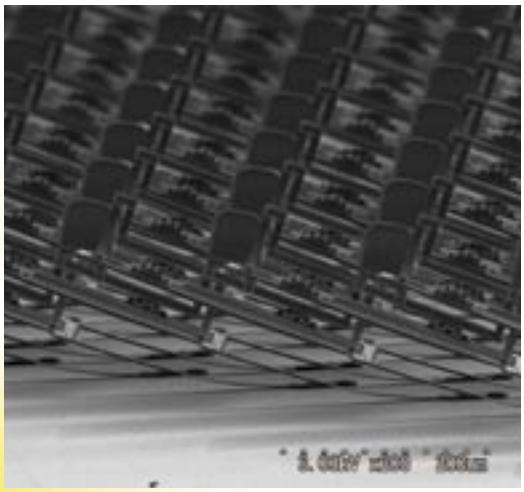
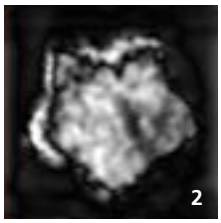
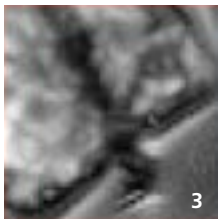




research and development





1. Nail embedded in a cookie
2. Terahertz image makes it possible to see the nail inside the cookie
3. Terahertz image (enlarged)

Nikon's research and development activities focus on opto-electronics and precision technologies, areas where Nikon has honed its competitive edge over decades. By combining core technical expertise with digital, control, information and communications technologies, Nikon R&D teams are involved in the development of many innovative products that bring together the benefits of different avenues of scientific research.

The nucleus of technical development at Nikon is the Core Technology Center, which undertakes basic research from a long-term perspective and is also engaged in the development of cutting-edge technology. The in-house companies and Nikon Group firms also conduct various R&D programs.

This report spotlights two areas with unique potential: MEMS and terahertz technologies.

Micro Electro Mechanical System (MEMS) technology

MEMS technology involves electromechanical systems that operate at the microscopic level. Nikon has developed a number of such devices using its core technical expertise in various areas. One example is a self-assembling microarray of mirrors. Nikon has succeeded in creating impressively solid structures from thin films of these mirrors, despite the films having a thickness of less than one micrometer. The internal stress characteristics of the thin-film structure result in the spontaneous creation of thin-film mirrors of approximately 50 micrometer square in area (pictured top left). These mirrors assemble into an integrated whole, onto which is added an array of microactuators that can move vertically (pictured top right). The whole creates a MEMS structure that combines a number of Nikon technologies.

MEMS technology brings together many of Nikon's proprietary skills in spatial optics, including lenses, prisms and mirrors. It heralds the advent of new optical devices and a wide range of fascinating technical possibilities that hitherto could only be imagined.

Terahertz (THz) technology

Terahertz light is a relatively unused part of the electromagnetic wave that offers significant potential advantages over X-rays for looking inside a wide variety of objects. With a frequency range around 10^{12} Hz (1 THz, or one trillion hertz) between visible light and radio waves, terahertz light passes through non-metallic substances such as paper and rubber. Detectors built using terahertz light could thus provide a wide range of security benefits, such as non-invasive screening of mail for banned substances or explosives, for example. Other potential applications include medical scans for cancer cells or tumors and food testing to detect dangerous substances.

Tochigi Nikon Corporation is the first company in the world to develop a commercial product based on terahertz technology. The terahertz pulse spectrometer is able to recognize substances using terahertz light shined onto the object passes through or is reflected. Since the system debuted in February 2004, several machines have already been sold to research institutions in Japan.

Tochigi Nikon is also developing real-time THz imaging systems. This technology has the potential to provide safer body scanning capabilities than X-rays. It promises to yield significant advances in fields such as security and medicine.