Nikon

Crystal Clear Imaging

Objectives for biological microscopes

CFI Plan Apochromat Lambda Series

CFI60

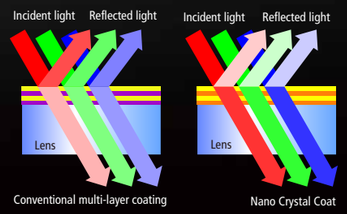
Nano Crystal Coat guarantees optimum brightness

Nikon's exclusive ultra-low refractive index coating technology "Nano Crystal Coat," used in the manufacture of professional SLR camera lenses, is now employed in the new CFI Plan Apochromat λ objective series. This technology enables remarkably high transmission throughout a broad range of wavelengths, from UV to the near-IR region. Offering bright, sharp, high-contrast images, these lenses are perfect for multi-color fluorescence live-cell imaging, particularly for fluorescent dyes with longer wavelengths that are less phototoxic to living specimens. Moreover, with the world's highest level of chromatic aberration correction, resolution and image flatness, they ensure the capture of high-quality brightfield images. Capable of visualizing the minute structures and dynamics of living cells or organisms, the CFI Plan Apochromat λ series supports bioscience research in its quest to reveal the mechanisms of life.

Nano Crystal Coat is Nikon's superlative coating technology

With its origins in Nikon's semiconductor manufacturing technology, Nano Crystal Coat is an anti-reflective coating that assimilates ultra-fine crystallized particles of nanometer size. With particles arranged in a spongy construction with uniform spaces between them, this coarse structure enables lower refractive indices, facilitating the passage of light through the lens. These crystallized particles eliminate reflections inside the lens throughout the spectrum of visible light waves in ways that far exceed the limits of conventional anti-reflective coating systems.

Nano Crystal Coat eliminates ghost effects caused by red light, an achievement that has taken a long time, and effectively reduces flare effects caused by light entering the lens at an angle.



High-quality materials and technology — the foundations of Nikon lens products

Nikon's extremely reliable high-tech products have incorporated the company's cutting-edge optical and precision technologies since 1917. Over the past century, Nikon has researched and developed optical glass products in combination with optical designs for cameras, microscopes, semiconductor exposure equipment and others.

The front lens, which is the lens element at the tip of a high-power objective, is extremely small and has a distinctive shape. A highly skilled expert must grind the lens by hand to meet the required high-precision standards and desired shape. The ground lens is then stringently and repeatedly checked using high-precision processing technology to ensure it meets Nikon's compulsory high performance.

Nikon Master Craftperson

Within the Nikon organization, there are dedicated personnel with the title of Nikon Master Craftperson. They have passed rigorous tests and possess a high degree of skill and expert knowledge, specifically for the production of objective lenses. Everyday, these "masters" utilize their techniques and knowledge to deliver unrivalled glass-based optical solutions.

Nikon draws upon experience and technologies that have been accumulated through the production of precision optics. This enables the transfer of skills and knowledge between semiconductor equipment, camera lenses and also in the production of microscope objective lenses. In 1976, Nikon released the CF (Chromatic aberration Free) objectives, which corrected chromatic aberration within the objective itself. These was followed in 1996 by the CFI60 (Chromatic aberration Free Infinity) series, which combined the benefits of the CF optics with an infinity corrected optical system. Since then, Nikon has met the needs of diverse bioscience research by manufacturing market-leading objective lenses such as the CFI Plan Apochromat VC series, CFI Apochromat TIRF series and CFI Apochromat λS series.

Stunningly sharp and clear imaging for applications from bioscience research and drug discovery to routine clinical analysis

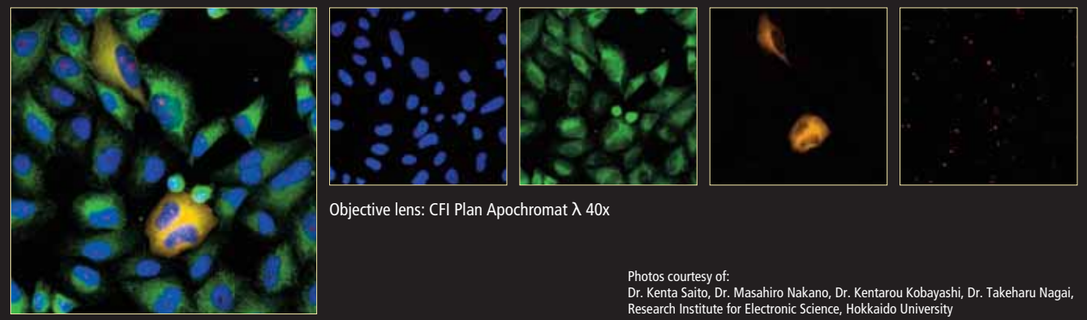
The newly developed high resolution CFI Plan Apochromat λ series objectives provide chromatic aberration correction throughout the wide wavelength range of 435 nm to 850 nm, and high transmittance up to the near IR range. They are suitable for acquiring bright, high-contrast, multi-wavelength fluorescence images, near IR images and confocal 3D images. They also capture clear and sharp brightfield images.

Multi-wavelength fluorescence image using multiple dyes

Image of HeLa cells labeled with four probes: Hoechst33342 (Nuclei, blue), Venus (Mitochondria, green), mCherry (a-tubulin, orange), Alexa 750 (Nucleoli, red)

Objective lens: CFI Plan Apochromat λ 100x oil

Image of HeLa cells labeled with four probes: Hoechst33342 (Nuclei, blue), Venus (Mitochondria, green), mCherry (a-tubulin, orange), Alexa 700 (Nucleoli, red)



Objective lens: CFI Plan Apochromat λ 40x

Photos courtesy of:
Dr. Kenta Saito, Dr. Masahiro Nakano, Dr. Kentarou Kobayashi, Dr. Takeharu Nagai, Research Institute for Electronic Science, Hokkaido University

Near-IR dye images

Indocyanine green (ICG) fluorescence image of mouse auricularis blood vessels

Excitation wavelength: 785nm
Peak emission wavelength: 832nm
Objective lens: CFI Plan Apochromat λ 20x

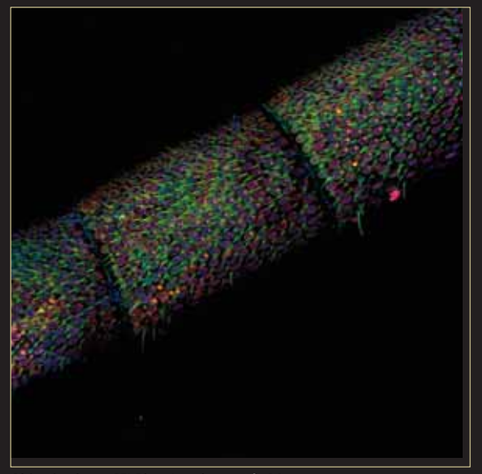
BALB/c mice were administered with IRDye800CW 2-DG via tail vein injection one week after the 4T1 breast cancer cells expressing mCherry were transplanted. Twenty-four hours post-injection, increased uptake of 2-deoxyglucose (red) in cells was observed, consistent with 4T1 breast cancer cells (blue) in the tumors, and increased sugar metabolism in the tumor cells was apparent.

Objective lens: CFI Plan Apochromat λ 20x

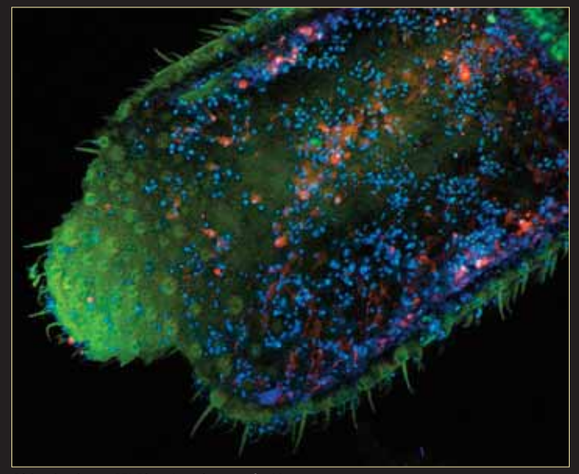
Photos courtesy of:
Hirofumi Inoue M.D., Ph.D., Department of Biochemistry and Molecular Genetics, Ehime University Graduate School of Medicine, Ehime-Nikon Bioimaging Core Laboratory, Proteo-Medicine Research Center (ProMRes), Ehime University

Three-dimensional fluorescence images

Honey bee antenna
DAPI: Cell nucleus
FITC: Dorsal branch of the antennal nerve
Rhodamine: Ventral branch of the antennal nerve



Objective lens: CFI Plan Apochromat λ 20x

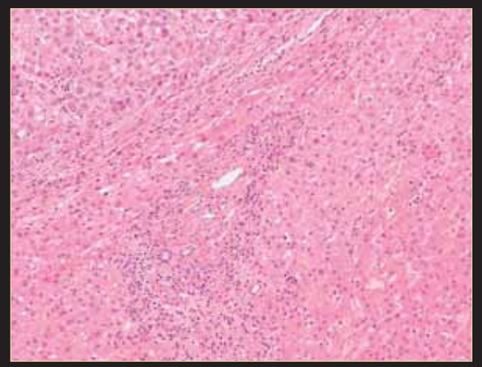


Objective lens: CFI Plan Apochromat λ 40x

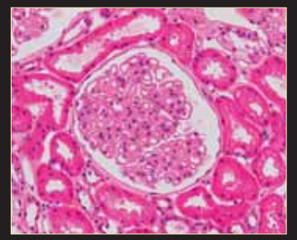
Specimen courtesy of:
Dr. Hiroshi Nishino and Dr. Takeharu Nagai, Research Institute for Electronic Science, Hokkaido University

Pathology examination image

Objective lens: CFI Plan Apochromat λ 10x



Membranous glomerulonephritis, HE staining
Objective lens: CFI Plan Apochromat λ 20x



Photos courtesy of:
Yoji Urata, MD. PhD, Department of Pathology, Kyoto City Hospital

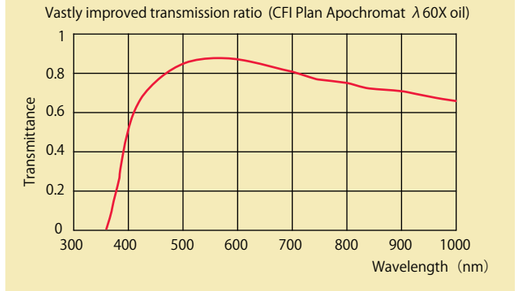
Gastric cancer, Ki-67 immunostaining
Objective lens: CFI Plan Apochromat λ 10x

Photos courtesy of:
Yoji Urata, MD. PhD, Department of Pathology, Kyoto City Hospital

High-resolution images with unbeatable brightness and sharpness at any magnification and wavelength

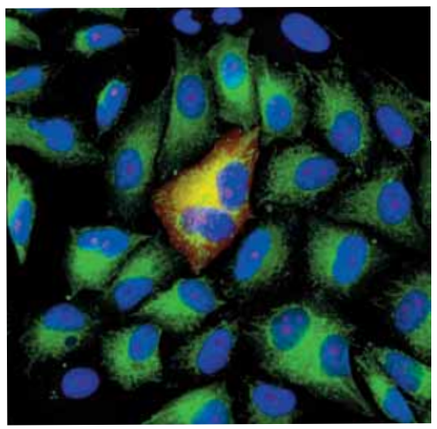
High transmission rates across a broad spectrum range

By incorporating Nikon's leading optical technologies and Nano Crystal Coat, the objectives have dramatically increased transmission rates throughout the entire visible range, from UV to near infrared. CFI Plan Apochromat λ objectives minimize the possibility of damage to live cells and enable long-term imaging thanks to their ability to image by maximizing brightness with minimum excitation intensity.



Chromatic aberration correction to near IR range

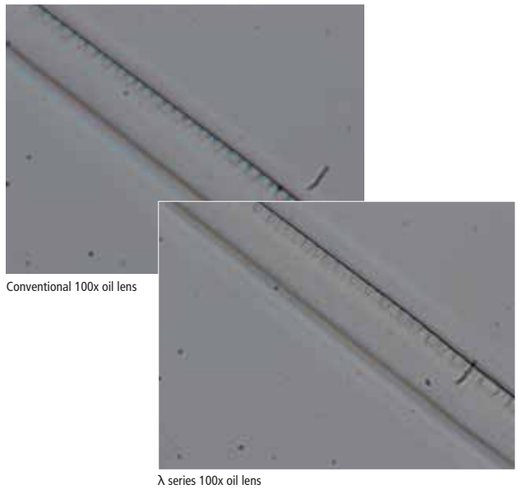
Chromatic aberrations are corrected over a wide wavelength range, extending from 435 nm to 850 nm, so crystal clear images are captured during multi-wavelength imaging. By correcting the focus shift for all wavelengths, the focus point is maintained when switching between dyes. More reliable intensity data for each color can be acquired when visualizing the structure and functions of a living specimen using multiple fluorescence proteins in confocal spectral imaging.



Capturing sharp images while focusing on multiple wavelengths
Photos courtesy of:
Dr. Kenta Saito, Dr. Masahiro Nakano, Dr. Kentarou Kobayashi, Dr. Takeharu Nagai, Research Institute for Electronic Science, Hokkaido University

High numerical aperture for bright images

Unprecedented high resolution with a high NA (Numerical Aperture) can be achieved at any magnification. The CFI Plan Apochromat λ 100x oil objective has an incredibly high NA of 1.45, enabling the capture of sharp, crystal clear images of minute structures. Moreover, the exceptional brightness of these lenses minimizes the use of excitation light to reduce the effects of photobleaching.



Conventional 100x oil lens

λ series 100x oil lens

High-resolution, high-contrast images of minute structures can be acquired with high NA of 1.45.
Specimen: Diatoms

Superior image flatness

Image flatness is maintained across the entire field of view for all objectives from low to high magnifications because of Nikon's outstanding optical design technology.

Unobtrusive lens shape

Searching for and confirming the observation point is difficult with conventional objectives that have a bulky lens top. There is always a risk that part of the lens could touch the specimen. The CFI Plan Apochromat λ series objectives have a more acute top lens design, offering more clearance around the lens top and making them less likely to interfere with the research and sample.

Pointed shape of lens top

Specifications

Model	NA	W.D. (mm)	Cover glass thickness	Correction ring	Brightfield	Darkfield	DIC	Phase contrast	Polarizing	Fluorescence (from visible light to NIR)
CFI Plan Apochromat λ 2X	0.10	8.50	—		◎	×	×	×	○	◎
CFI Plan Apochromat λ 4X	0.20	20.00	—		◎	×	×	×	○	◎
CFI Plan Apochromat λ 10X	0.45	4.00	0.17		◎	△	◎	×	○	◎
CFI Plan Apochromat λ 20X	0.75	1.00	0.17		◎	Dry/Oil	◎	×	○	◎
CFI Plan Apochromat λ 40X	0.95	0.21	0.11-0.23	√	◎	Oil	◎	×	○	◎
CFI Plan Apochromat λ 60X	0.95	0.15	0.11-0.23	√	◎	Oil	◎	×	○	◎
CFI Plan Apochromat λ 60X oil	1.40	0.13	0.17		◎	×	◎	※	○	◎
CFI Plan Apochromat λ 100X oil	1.45	0.13	0.17		◎	×	◎	※	○	◎
CFI Plan Apochromat λ DM 20X	0.75	1.00	0.17		○	Dry/Oil	×	◎	×	○
CFI Plan Apochromat λ DM 40X	0.95	0.21	0.11-0.23	√	○	Oil	×	◎	×	○
CFI Plan Apochromat λ DM 60X	0.95	0.15	0.11-0.23	√	○	Oil	×	◎	×	○
CFI Plan Apochromat λ DM 60X oil	1.40	0.13	0.17		○	×	×	◎	×	○
CFI Plan Apochromat λ DM 100X oil	1.45	0.13	0.17		○	×	×	◎	×	○

※: External phase contrast observation is possible with ECLIPSE Ti series
◎: Recommended for best results
○: Suitable
△: Possible but not recommended
×: Not possible
—: Can be used without cover glass

N Nano Crystal Coat-deposited

Nikon live-cell imaging objective range

CFI Apochromat λS Series, CFI Plan Apochromat IR lens, CFI 75 Apochromat MP lens

These top-grade objectives all employ Nikon's unique Nano Crystal Coat technology and are the perfect choice for live-cell imaging thanks to their incomparable high numerical aperture as immersion objectives. The λS series corrects chromatic aberration from UV to infrared, making it ideal for spectral imaging and simultaneous multi-wavelength acquisition. The CFI Apochromat LWD 40x WI λS and CFI 75 Apochromat 25x W MP lens are just right for deep imaging of living specimens with multi-photon excitation.

CFI 75 Apochromat 25x W MP (NA: 1.10, WD: 2.00)
CFI Apochromat 40x WI λS (NA: 1.25, WD: 0.18)
CFI Apochromat LWD 40x WI λS (NA: 1.15, WD: 0.60)
CFI Apochromat 60x oil λS (NA: 1.40, WD: 0.14)
CFI Plan Apochromat IR 60x WI (NA: 1.27, WD: 0.17)

CFI Plan Apochromat VC* Series

With incredible brightness and aberration correction across the entire field of view, the CFI Plan Apochromat VC series is the ideal choice for multi-stained, fluorescence specimens and for use in brightfield and DIC techniques. Axial chromatic aberration has been corrected up to 405 nm, so the series is highly effective in photo-activation application and confocal imaging.

*Violet Corrected

CFI Plan Apochromat VC 100x oil (NA: 1.40, WD: 0.13)
CFI Plan Apochromat VC 60x oil (NA: 1.40, WD: 0.13)
CFI Plan Apochromat VC 60xA WI (NA: 1.20, WD: 0.31-0.28)
CFI Plan Apochromat VC 20x (NA: 0.75, WD: 1.00)

CFI Apochromat TIRF Series

With the highest NA available using standard immersion oil and a coverslip, the CFI Apochromat TIRF series is the perfect choice for TIRF (Total Internal Reflection Fluorescence) imaging. The outstanding IR throughput allows imaging and trapping in the same focal plane. The unique correction ring compensates for the changes in spherical aberration that occur at different temperatures.

CFI Apochromat TIRF 60x oil (NA: 1.49, WD: 0.12)
CFI Apochromat TIRF 100x oil (NA: 1.49, WD: 0.12)

N Nano Crystal Coat-deposited

⚠ WARNING	TO ENSURE CORRECT USAGE, READ THE CORRESPONDING MANUALS CAREFULLY BEFORE USING YOUR EQUIPMENT.

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Printed in Japan (1104-05)T
Code No. 2CE-MQUH-1
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