Nikon Technology Maximizes the Potential of Fluorescence Images

Nikon offers a wide range of filter blocks, from general epi-fluorescence use to those dedicated for a specific fluorescent reagent, for supporting today’s variety of fluorochromes. With a standard filter diameter of 25 mm, commercially available fluorescence filters can be exchanged by users according to the desired use.

**Product Lineup**

### Fluorescence filter blocks

General fluorescence filters corresponding to various excitation colors such as B-2A and G-2A. Since many of the barrier filters are the long-pass type, numerous reagents can be supported by a single filter.

#### Deciphering filter names

- **Excitation color**: B is blue, D is green, and so on
- **Excitation filter bandwidth**: 1 is narrowband (up to 20 nm), 2 is mediumband (20 to 50 nm), 3 is super wideband (60 nm and up)
- **Filter type**: A and B are long-pass types, B has a longer cutoff wavelength, E is a band-pass type

**Example**: B - 2 A

### Filter blocks for fluorescent reagents and fluorescent proteins

Filters corresponding to specific fluorescent reagents such as DAPI and FITC. Since the band-pass type is common on the barrier filter side, autofluorescence of plants, for example, is suppressed, enabling clear images with low background noise.

### High-quality filter blocks for fluorescent protein

The Wavelength cut-on and cut-off rise to peak is very steep, much more than for ordinary filter blocks for fluorescent proteins, thereby enhancing transmittance. Employing this filter makes it possible to obtain extremely clear, bright and non-overlapping fluorescent images.

### Multiband filter blocks

Filters that enable the simultaneous observation of double or triple staining techniques such as DAPI-FITC-Texas Red. Since there is no need to switch filter blocks in multi-stained fluorescence observation, there will be no position deviation of fluorescence filters, and no need to use the merge function of capture software when shooting with a color camera.

### Noise Terminator

Excitation light that barely passes through without being totally reflected by the dichroic mirror can be a source of noise. The noise terminator is installed to appropriately process excitation light (stray light) that passed through the dichroic mirror, thereby preventing the light from reflecting in the filter block and leaking into the observation side. This makes it possible to obtain fluorescence images with extremely low background noise and a high S/N ratio.

The Noise Terminator comes standard with Nikon fluorescence microscopes.

### High-performance filter cassette holder

The epifluorescence filter cassette holder for the TE2000E/UIS delivers superb performance, especially when combined with TIRF systems. It is the optimum choice for TIRF illumination in all types of excitation methods because it minimizes the deviation of the focal point of the light source on the objective pupil plane due to filter cassette switching.

### Freedom of switching filters

The optimal combination for the purpose of your observation can be created by easily removing the excitation filter, barrier filter, and/or the dichroic mirror.

Now you can capture fluorescence images with higher contrast than ever. In addition to the superb optical performance of its filters, as well as its high signal-to-noise ratio optical system, Nikon employs a proprietary Noise Terminator in its fluorescence systems. This enables clear images, even with weak fluorescence.

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**Example with an inverted microscope**

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**Noise terminator**

(Example with an inverted microscope)
### Spectral Characteristics Table for Filters

#### UV excitation

<table>
<thead>
<tr>
<th>Filter</th>
<th>EX</th>
<th>DM</th>
<th>BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV-2A</td>
<td>EX300-380</td>
<td>DM400</td>
<td>BA420</td>
</tr>
<tr>
<td>UV-1A</td>
<td>EX305-380</td>
<td>DM400</td>
<td>BA400</td>
</tr>
<tr>
<td>UV-2B</td>
<td>EX400-440</td>
<td>DM550</td>
<td>BA470</td>
</tr>
<tr>
<td>BV-2A</td>
<td>EX315-440</td>
<td>DM455</td>
<td>BA470</td>
</tr>
<tr>
<td>BV-1A</td>
<td>EX435/10</td>
<td>DM455</td>
<td>BA470</td>
</tr>
<tr>
<td>BV-1E</td>
<td>EX435/10</td>
<td>DM500</td>
<td>BA520-560</td>
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</table>

#### V excitation

<table>
<thead>
<tr>
<th>Filter</th>
<th>EX</th>
<th>DM</th>
<th>BA</th>
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</thead>
<tbody>
<tr>
<td>V-2A</td>
<td>EX350-420</td>
<td>DM430</td>
<td>BA450</td>
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<tr>
<td>V-2A</td>
<td>EX365-10</td>
<td>DM400</td>
<td>BA420</td>
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<tr>
<td>BV-2A</td>
<td>EX400-440</td>
<td>DM550</td>
<td>BA470</td>
</tr>
<tr>
<td>BV-1A</td>
<td>EX435/10</td>
<td>DM455</td>
<td>BA470</td>
</tr>
<tr>
<td>BV-1E</td>
<td>EX435/10</td>
<td>DM500</td>
<td>BA520-560</td>
</tr>
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</table>

#### B excitation

<table>
<thead>
<tr>
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<th>EX</th>
<th>DM</th>
<th>BA</th>
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</thead>
<tbody>
<tr>
<td>B-3A</td>
<td>EX420-490</td>
<td>DM505</td>
<td>BA520</td>
</tr>
<tr>
<td>B-2A</td>
<td>EX450-490</td>
<td>DM505</td>
<td>BA520</td>
</tr>
<tr>
<td>B-1A</td>
<td>EX470-490</td>
<td>DM505</td>
<td>BA520-560</td>
</tr>
<tr>
<td>B-1E</td>
<td>EX470-490</td>
<td>DM500</td>
<td>BA520-560</td>
</tr>
<tr>
<td>G-1B</td>
<td>EX510-560</td>
<td>DM575</td>
<td>BA590</td>
</tr>
<tr>
<td>G-2B</td>
<td>EX510-560</td>
<td>DM575</td>
<td>BA590</td>
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</table>

#### G excitation

<table>
<thead>
<tr>
<th>Filter</th>
<th>EX</th>
<th>DM</th>
<th>BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-2A</td>
<td>EX420-490</td>
<td>DM505</td>
<td>BA520</td>
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<tr>
<td>G-1B</td>
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<td>BA520</td>
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<tr>
<td>G-2B</td>
<td>EX470-490</td>
<td>DM505</td>
<td>BA520</td>
</tr>
<tr>
<td>G-2A</td>
<td>EX420-490</td>
<td>DM505</td>
<td>BA520</td>
</tr>
<tr>
<td>B-1E</td>
<td>EX435/10</td>
<td>DM500</td>
<td>BA520-560</td>
</tr>
</tbody>
</table>

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EX: Excitation filter  DM: Dichroic mirror  BA: Absorption filter

Fluorescence Filter Blocks from Nikon
Fluorescence Filter Blocks from Nikon

Special filter blocks for fluorescent reagents and fluorescent proteins

DAPI

Texas Red

Cy7 Chroma Technology equivalent: 41007a

BFP Chroma Technology equivalent: 31007a

FITC

Cy3 Chroma Technology equivalent: 41008

GFP LP Long-pass type

CFP Chroma Technology equivalent: 31008a

TRITC

Cy5 Chroma Technology equivalent: 41009

GFP BP Band-pass type

YFP Chroma Technology equivalent: 41009a

Chroma Technology equivalent: 41007a

Chroma Technology equivalent: 31007a

Chroma Technology equivalent: 41008

Chroma Technology equivalent: 31008a

Chroma Technology equivalent: 41009

Chroma Technology equivalent: 31009a

1) Fluorescence Filter Blocks from Nikon

Special filter blocks for fluorescent reagents and fluorescent proteins
Fluorescence Filter Blocks from Nikon

**Multiband filter blocks**

- **DAPI/FITC**
  - [Chroma Technology equivalent: 51000]
- **FITC/TRITC**
  - [Chroma Technology equivalent: 51004]
- **DAPI/FITC/Texas Red**
  - [Chroma Technology equivalent: 51006]
- **FITC/Texas Red**
  - [Chroma Technology equivalent: 61000]

**Reagent Compatibility Table**

<table>
<thead>
<tr>
<th>Reagent</th>
<th>EX</th>
<th>EM</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>450</td>
<td>FITC/B-2A</td>
</tr>
<tr>
<td>405</td>
<td>430</td>
<td>R-2A, B-2A</td>
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<tr>
<td>488</td>
<td>470</td>
<td>R-2A, B-2A</td>
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<tr>
<td>495</td>
<td>450</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>535</td>
<td>405</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>540</td>
<td>490</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>570</td>
<td>460</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>590</td>
<td>510</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>610</td>
<td>530</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>640</td>
<td>540</td>
<td>R-2A, B-2A</td>
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<tr>
<td>670</td>
<td>550</td>
<td>R-2A, B-2A</td>
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<td>700</td>
<td>570</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>720</td>
<td>600</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>750</td>
<td>620</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>770</td>
<td>640</td>
<td>R-2A, B-2A</td>
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<tr>
<td>800</td>
<td>650</td>
<td>R-2A, B-2A</td>
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<tr>
<td>850</td>
<td>670</td>
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<tr>
<td>880</td>
<td>700</td>
<td>R-2A, B-2A</td>
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<tr>
<td>910</td>
<td>720</td>
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<tr>
<td>950</td>
<td>750</td>
<td>R-2A, B-2A</td>
</tr>
<tr>
<td>980</td>
<td>770</td>
<td>R-2A, B-2A</td>
</tr>
</tbody>
</table>

**Specific Energy Distribution**

- **Mercury lamp**
  - [Chroma Technology equivalent: 51000]
- **Xenon lamp**
  - [Chroma Technology equivalent: 51004]

**Typical reagents**

- **EX**
  - **EM**
- **ACMA 430 474 BV-2B**
- **Acridine Orange (DNA+RNA) 540 580**
- **Alexa Fluor 350 440 442 UV-2A**
- **Alexa Fluor 488 495 519**
- **Alexa Fluor 568 579 604 G-2A**
- **Alexa Fluor 647 653 669 Cy5**
- **Allophycocyanin (APC) 650 660 Cy5**
- **BCECF (high ph) 503 528**
- **BFP (Blue Fluorescent Protein) 381 445**
- **Calcein 494 517**
- **Calcium Green-1 506 531**
- **Cascade Blue 370 425**
- **CFDA (Carboxyfluorescein) 495 520**
- **CFP (Cyan Fluorescent Protein) 458 480**
- **Cy2 489 506**
- **Cy3 550 570**
- **Cy5 649 670**
- **DAPI 358 461**
- **DiOC6 480 501**
- **Dil 549 565**
- **DsRed (Red Fluorescent Protein) 558 583**
- **Eosin**
- **Ethidium bromide 545 605**
- **FITC 494 518**
- **Fluo3 506 526**
- **FluoroGold 368 565**
- **FM1-43 502 625**
- **Fura2 335 505**
- **Fura Red 472 646**
- **Hoechst 33342 & 33258 352 461**
- **Indo1 330 401**
- **JC-1 514 529**
- **Lissamine rhodamine B 570 590**
- **Lyso Tracker Green 505 511**
- **MitoTracker Green 490 516**
- **MitoTracker Orange 551 576**
- **Monochlorobimane 380 461**
- **NBD (amine) 460 534**
- **Nile Red 549 628**
- **Rhodamine123 507 529**
- **SYTOX 504 523**
- **Texas Red 577 620**
- **TMR (Tetramethylrhodamine) 555 580**
- **TO-PRO-3 642 661**
- **TOTO-3 642 660**
- **XRITC (X-rhodamine-5) 580 605**
- **YOYO-1 491 509**

**Specific Energy Distribution**

- **Reagent Compatibility Table**
  - [Chroma Technology equivalent: 51000]
  - [Chroma Technology equivalent: 51004]
  - [Chroma Technology equivalent: 51006]
  - [Chroma Technology equivalent: 61000]
  - [Chroma Technology equivalent: 61002]
Special Filter for Detecting Qdot® Conjugates

Qdot® conjugates have several special features, including extremely slow color fading, and it is winning acclaim as a new labeling tool for fluorescence observation. Nikon now offers a dedicated Qdot® detection filter, which maximizes the performance of the fluorescent probe.

Qdot® nanocrystals

The quantum dot conjugate is made from nanometer-scale crystals of semiconductor material, and the color of light that they emit differs depending on the particle size. Qdot® conjugates are nanocrystals for labeling biomolecules such as antibodies and streptavidin. Unlike conventional organic dyes, Qdot® offers the following advantages:

1. Extremely slow color fading and long-term photo stability
2. Extremely high fluorescence intensity
3. Extremely sharp detection of wavelength distribution, enabling the simultaneous detection of different colors without any overlap
4. Compatible with all manner of optical microscopes, including confocal models

Absorbance spectra (solid line) and emission spectra (dotted line) of Qdot® Streptavidin Conjugates and fluorescence detect filter sets (Chroma Technology)

Selecting an excitation filter

Select a filter that satisfies the excitation wavelength of the fluorescent substance being observed. Since applying intense light in a wavelength range other than the excitation wavelength of the fluorescent substance enables highly efficient excitation, it is necessary to pay attention not only to the rising wavelength, but also the inclination of the rise. A dichroic mirror with a gentle rising edge may end up lowering the transmittance of the fluorescence signal and produce an unwanted crossover fluorescence emission signal.

Selecting a dichroic mirror

When comparing the spectral property curve of a dichroic mirror measured at a 45° angle, select a mirror for which the rising wavelength in the transmission range is slanted from the excitation wavelength and fluorescent wavelength of the fluorescent substance. When the excitation wavelength and fluorescent wavelength of the fluorescent substance are close to each other, select a dichroic mirror that rises closer to a shorter wavelength in order to transmit the fluorescence signal as much as possible. With a dichroic mirror, it is necessary to pay attention not only to the rising wavelength, but also the inclination of the rise. A dichroic mirror with a gentle rising edge may end up lowering the transmittance of the fluorescence signal and produce an unwanted crossover fluorescence emission signal.

Combining an excitation and barrier filter

When the wavelength properties of an excitation filter and barrier filter overlap, ideally, no light at all will pass through. Since fluorescence is a weak beam, even the slightest bit of light leakage will cause the background noise to rise, inviting degraded image quality.