

# Capture all polarization information from your sample at a glance.



## **ZEISS Axiocam 705 pol**

Your scientific 5 megapixel microscope camera  
for single-shot polarization imaging.

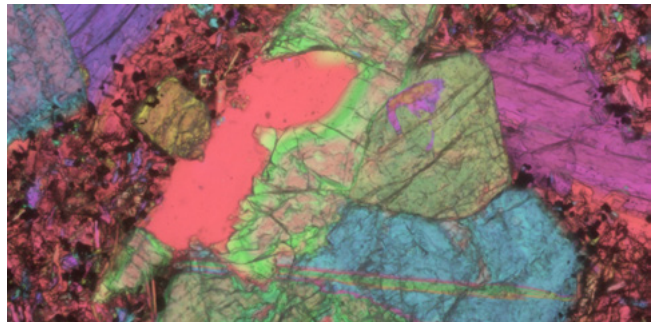
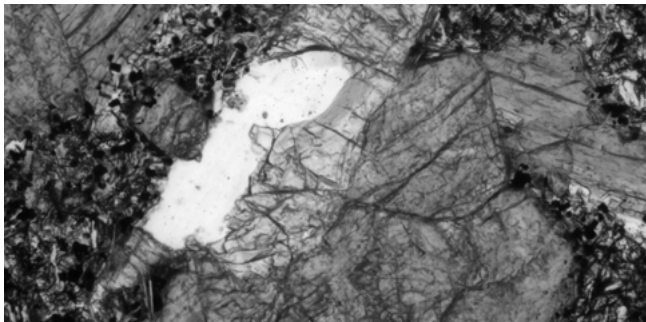
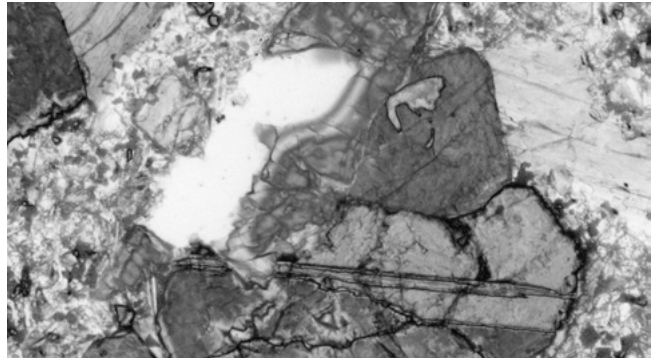
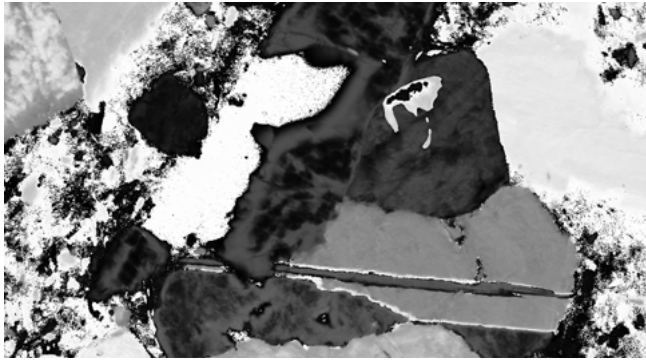
[zeiss.com/axiocam705-pol](https://zeiss.com/axiocam705-pol)



Seeing beyond

# ZEISS Axiocam 705 pol

Your scientific 5 megapixel microscope camera for single-shot polarization imaging.



*Basalt thin section, Axiocam 705 pol, 4 channels*

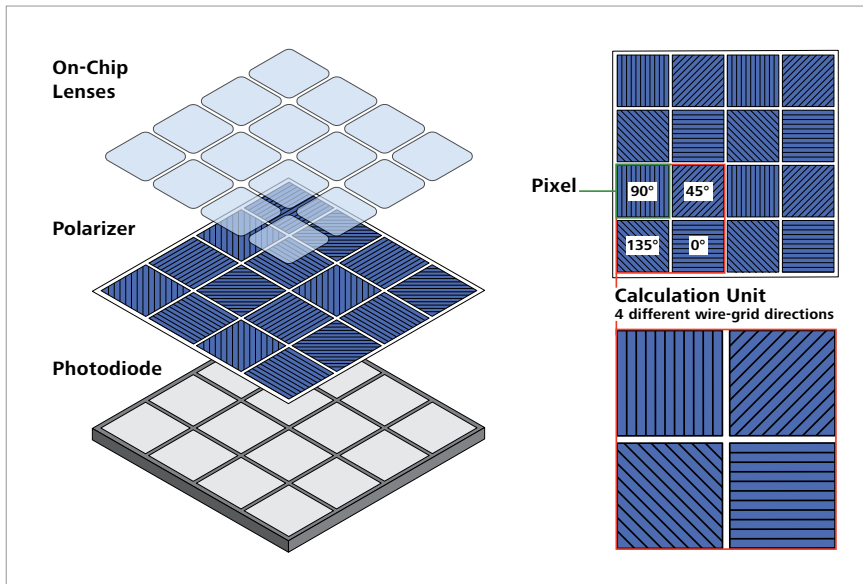


Axiocam 705 pol is your scientific 5 megapixel camera with a polarization filter mask enhanced sensor. A single image is sufficient to capture different polarization parameters such as angle of polarization, degree of polarization together with the image content. No special accessories such as an analyzer in your microscope are required. You simultaneously acquire polarization effects with one single exposure over the field of view which speeds up your imaging as no analyzer needs to be adjusted.

The “four-directional polarizer” located between photodiodes and micro lenses generates a sensor raw image with four polarization directions ( $0^\circ$ ,  $45^\circ$ ,  $90^\circ$  or  $135^\circ$ ) in one image by the principle of linear polarization filters. A different intensity is measured for each angle of the polarizing filters. Four adjacent pixels in a  $2 \times 2$  cluster with their four different polarization filters form a “observation unit”. The real 5 megapixels of the sensor are thus divided into 4 smaller images for one polarization angle each, but their image content reflects the same moment. This means that the camera has the optimum output data for calculating the full polarization information at every spot in the image – and that with every shot.

Based on the Stokes parameter theory polarization information with the three values Angle of Polarization (AoP), Degree of Polarization (DoP) and Intensity can be derived from the measured intensities of the four polarization channels.

Optionally, these three values can be visualized in an understandable way by color encoding. In this color image, the angle of polarization is encoded by the color hue, the degree of polarization is encoded by the color saturation and the intensity is added from the monochrome intensity derived from the polarized image.



Sensor pixel layout for polarization detection

### Highlights

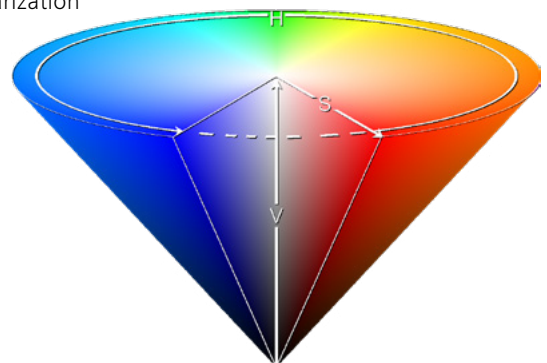
- 5-megapixel cooled polarization sensitive CMOS sensor
- Meaningful methods for visualization of multiple polarization parameters
- Low readout noise and analogue signal amplification
- Dynamic range of 1:25,000 in high-dynamic range (HDR) mode
- Small 6.9  $\mu\text{m}$  per polarization pixel unit for high-resolution imaging
- Hardware triggering

### Recommended for:

- Material discrimination
- Kerr microscopy
- Mineralogy
- Glass and transparent materials
- Materials research
- Live cell imaging

### Representation of the acquired image information with Axiocam 705 pol

- Encoded Pseudo Color 4 Channel Image
- Channel 1 = Angle of Polarization
- Channel 2 = Degree of linear Polarization
- Channel 3 = Intensity
- Channel 4 = Color encoded information derived from above channels
- Method of color encoding in HSV color space
  - Hue = Angle of polarization
  - Saturation = Degree of linear Polarization
  - Value = Intensity



<https://de.wikipedia.org/wiki/HSV-Farbraum>

# Technical Specifications

Technical Data			
Sensor type	Sony CMOS image monochrome sensor, global shutter architecture		
Polarisation Filter	On chip polarization filter mask with 0°, 45°, 90°, 135° transmission directions in 2x2 pixel arrangement		
Sensor size	Image diagonal 11.1 mm, equivalent to $\frac{2}{3}$ " sensor format (8.5 mm x 7.1 mm)		
Pixel count	2464 (H) x 2056 (V) = 5.07 megapixel		
Pixel size	3.45 µm x 3.45 µm, 6.9 µm effective pixel size based on polarization filter cell size		
Bit depth	14 bit, 12 bit or 8 bit / pixel		
Exposure range	from 0.1 ms to 60 s		
Gain	1x, 2x, 4x, 8x, 16x,		
Binning	1x1		
Dark current signal	< 0,5 e/pixel/s at sensor temperature 18 °C		
Frame rate	25 fps live image (in monochrome or fast color mode)		
	H x V (ROI)	Frame Rate (fps – framerates only in monochrome or fast color coding)	
	2464 x 2056	60	
	1920 x 1080	115	
	1024 x 1024	121	
	512 x 512	235	
Dynamic range	Read Noise (gain)	Full Well	Dynamic Range
	2.20 e (1x)	11,000 e	1:5,000
	1.74 e (2x)	5,000 e	1:3,100
	1.48 e (4x)	2,700 e	1:1,800
	1.29 e (8x)	1,300 e	1:1,300
	1.15 e (16x)	690 e	1:600
High dynamic range (HDR) mode	Extended dynamic range 1:25,000		
Cooling system	Active thermoelectric cooling, regulated sensor temperature 18 °C		
Spectral sensitivity	Approx. 350 nm – 1000 nm, protection glass (coated)		
Interfaces	USB 3.0 (data & power) and USB 2.0 (power only)		
Trigger ports	Trigger-in, trigger-out, status readout		
Power supply	By USB 3.0 and USB 2.0, 7 W power consumption		
Operation system	Windows 10 Pro / Ultimate		
Software	ZEN (blue edition), ZEN core		
Image processing functions	Angle of polarization, degree of polarization, intensity channel, pseudo-color visualization		
Automatic features	Automatic exposure time optimization		
Optical/mechanical interface	C-Mount		
Dimensions and weight	10.8 cm x 7.8 cm x 4.3 cm (2.3" x 3.2" x 1.7"), 580 g		
Order number	426560-9070-000		

## Please note:

Due to the 2x2 polarization selective pixel mask some standard AxioCam modes are not available: Binning, Subsampling  
The produced color images are pseudo color images. The encoding process can slow down the maximum frame rate of the camera hardware.  
No circular polarization detectable by this working principle.  
The color value of the „Angle of Polarization“ is repeating if the measured polarization angle is larger than 180 degree.



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