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Practice quiz Optical microscopy: inspection and dimension measurement

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Questions:

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1. A defined structure on a calibration sample has a width of 50 μm . Using the 50x objective, a corresponding number of 96 pixels is determined. How wide (in micrometer) is a sample that is 86 pixels wide using the 20x objective?

☐ 18 μm

☒ 112 μm

☐ 66 μm

☐ 413 μm



Explanation

Based on the calibration measurement, 1 pixel corresponds to $50/96=0.52 \mu\text{m}$. Thus, 86 pixels would correspond to $50/96*86=44.8 \mu\text{m}$ using the same lens. However, due to the 2.5 times smaller magnification of the 20x objective, the structure appears by that factor smaller. Hence, the actual dimension of the structure is $44.8*2.5=112 \mu\text{m}$.

For further information, please see video "Optical microscopy" at 06:33.

2. Which of the following parts are additionally necessary when performing differential interference contrast (DIC) mode imaging on an optical microscope operated in the bright field (BF) mode?

☒ Nomarski prism

☒ Polarizer

☐ Patch stop

☐ Aperture

☒ Analyzer

☐ Laser



Explanation

In DIC mode, a polarizer polarizes the incoming light. The Nomarski prism splits the incoming light into two beams that are polarized at 90° to each other which then are focused on two adjacent spots on the sample with a distance of approximately 200 nm. The Nomarski prism recombines the two polarized rays and allows the interference monitoring.

The analyzer is to filter out the unwanted light like the directly transmitted light.

There is no need for an additional aperture or laser source in DIC mode. The Patch stop is used in DF mode only.

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For further information, please see video "Optical microscopy" at 02:54, and the reference link "Details about DIC" in the previous text module.

3. Which of the following statements are true regarding the comparison of the bright field (BF) and dark field (DF) imaging mode in optical microscopy?

☐ An aperture in DF mode blocks the outer part of the light beam thereby decreasing the image brightness

☒ The DF mode enhances the detection of scattered light from the sample

☐ The BF mode shows surface irregularities better than DF

☒ BF images show the samples' true colors

☐ The microscope setup is exactly the same

☐ For the DF mode a different light source is needed

☒ BF and DF modes provide complementary information on the sample surface and thus both should be used for the investigation of MEMS surfaces



Explanation

In DF mode, a patch stop blocks the central part of the light beam instead of the outer part.

DF mode is better suited to reveal surface irregularities because it detects scattered light and the brightness of the background is lower compared to the BF mode.

The same light source can be used in both BF and DF mode.

For further information, please see video "Optical microscopy" at 02:54 and 04:28.

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