

Fig. 2 (b) shows the experimental SNOM images recorded under normal incidence in transmission mode. The incident polarization is switched in the middle of the image (white dashed line) from horizontal (bottom of the image) to vertical (top of the image). The TE_{01} mode being excited for a polarization parallel to width b of the slit, the vertical slits are excited in the lower part of the image and the horizontal ones in the upper part, showing respectively vertical and horizontal lines in the images. The period of these lines is about 300 nm as the period of each primary gratings consisting in vertical or horizontal slits. Moreover hot spots can be distinguished along each line: they correspond to the position of the slits and once again it suits the period of 300 nm.

A zoom-in on the near-field optical image including the polarization switch is shown in Fig. 3. The position of the slits is deduced from the shear force image (not shown here) and it is marked by black rectangles (note the slight angle to the x axis around 5 degrees). One can clearly conclude that dark spots are located above the slits parallel to the incident polarization and bright spots above the perpendicular ones. If the polarization is turned of 90 degrees, bright (respectively dark) slits become dark (respectively bright). The non perfect distribution of the light inside the slits may be related to the difficulty to correctly align the polarization along one edge of the slits (the shear force image reveal a 5 degrees angle between the polarization and the longest edge of the slits) and to the use of a dielectric tip.

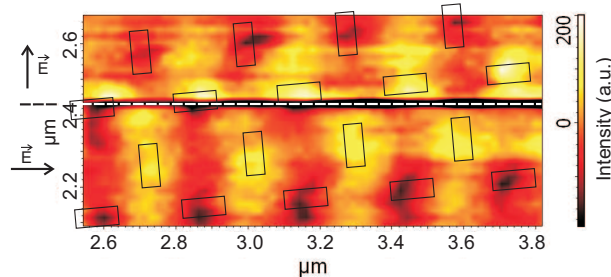


Fig. 3: Zoom-in around the center of the near-field optical image of figure 2. The black rectangles mark the slit positions deduced from the shear force image.

4. Conclusion

In summary, we have demonstrated a very simple way to control the near field of nanostructures by adjusting the linear polarization of the incident field. The experimental optical images clearly demonstrate the sub- λ confinement of light because the nearest slits centers are only around 200 nm away i.e. $\lambda/3$. The control of the spatial distribution is simply achieved through the control of the incident polarization. These kind of nanostructures offers a convenient and versatile way to sub-wavelength light confinement.

References

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