

Raman Imaging of Holographic Gratings Inscribed on Polymer Thin Films.

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Raman image (Figure 1) from a thin film of azobenzene-containing polymer thin film (300 nm) that is periodically structured (periodicity of $\sim 1 \mu\text{m}$). Raman measurements were recorded with a Labram HR 800 (HORIBA JobinYvon) spectrometer combined with an inverted microscope (Olympus IX 71) and a X,Y Piezoelectric stage to position the sample with the best accuracy and repeatability. A 100X, 0.9 NA microscope objective was used. A Raman spectrum (Fig. 2) was recorded every 100 nm along the X and Y directions with an integration time of 5 seconds per spectrum (λ excitation=752.4 nm). The variation of the Raman signal was integrated over the $[1060-1180]\text{cm}^{-1}$ spectral domain (Figure 3). It must be pointed out that details on the Raman profile are obtained with a spatial resolution better than $\lambda/2$ (at the diffraction limit).

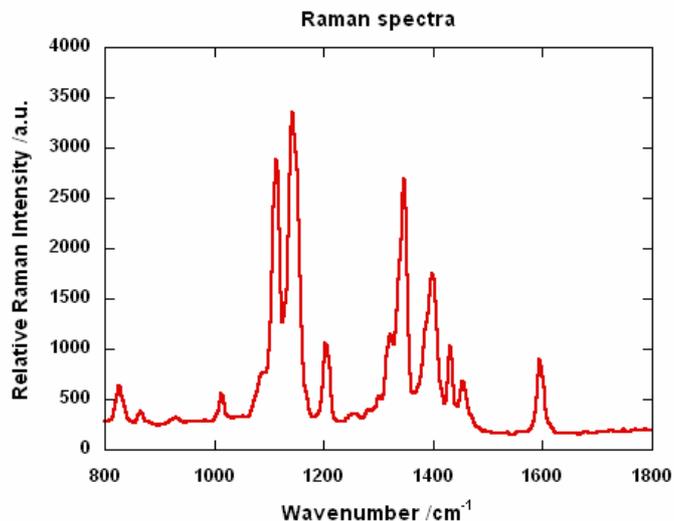


Figure 2: Raman Spectra of azobenzene polymer. Acquisition time 5 sec.

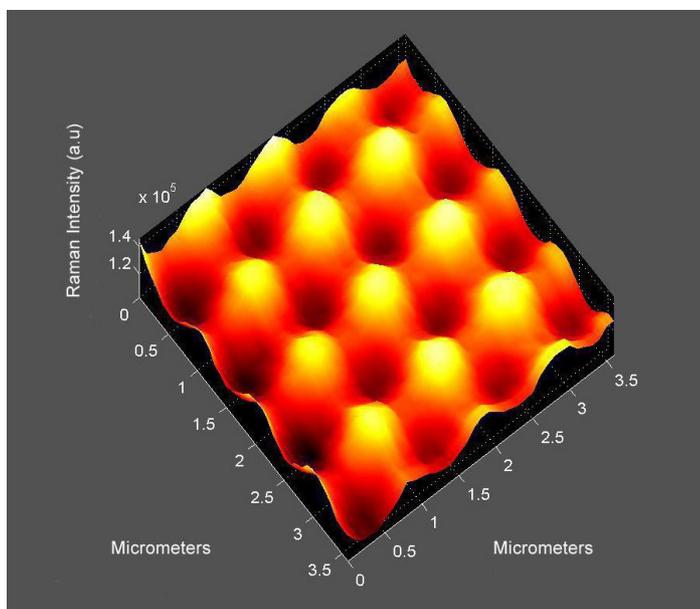


Figure 1

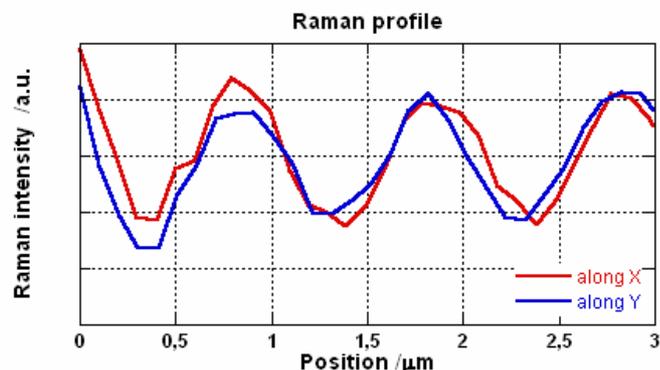


Figure 3: Variation of the Raman intensity over the X and Y directions.



About the inscription of the two-dimensional grating...

Using holographic techniques we have structured the surface in a one step procedure (no wet nor photocuring processing) along the X and Y directions. A grating is first inscribed with grooves along the X direction, the sample is rotated by 90° and a second grating is inscribed with grooves along the Y direction. The intensity of the 1st diffracted orders is monitored to have equal intensities in both X and Y directions. The atomic force microscopy (AFM) images shown in Fig.3 exhibit a periodic structure on large surfaces with a height amplitude varying from 50 to 110 nm.

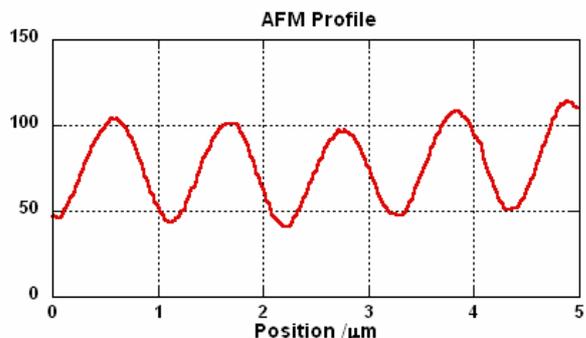


Figure 3: AFM images in 3D and 2D representations and profile of the height variations.

References

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