

Supplementary Material for:

“Optical properties of tungsten: a parametric study to characterize the role of roughness, surface composition and temperature.”

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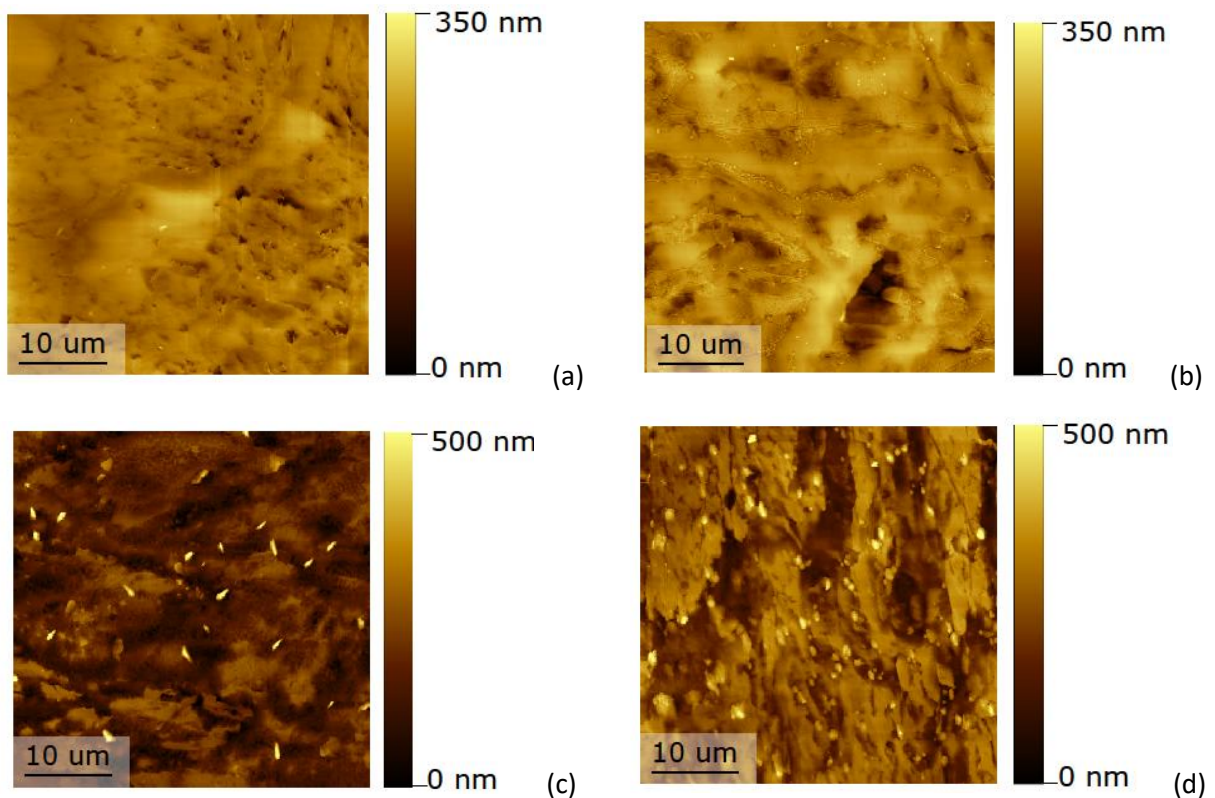
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- **Introduction**

In this work, we studied the role of morphology and temperature on the optical response of tungsten (W). We measured the reflectivity of five W samples with different roughness in the range 20-100 nm during laser annealing up to 800°C, and observed an increase of the reflectivity after the annealing. We measured the RMS roughness (σ) of the samples with Atomic Force Microscopy (AFM) and Confocal Microscopy (CM), and we have seen that σ does not significantly vary in the investigated temperature range. We then demonstrated that the increase of reflectivity is rather due to a change in the chemical composition of the surface, as confirmed by XPS measurements.

- **AFM images**

Figure S1 shows 40x40 μm^2 AFM images of the 5 samples, before (left side) and after (right side) the annealings. We can observe that going from W1 to W5 before the annealing (left column) the surface appears more rough as expected, but we cannot distinguish visible changes for all samples after the heating, with maybe the only exception of W2 which has the biggest roughness increase after the annealing.



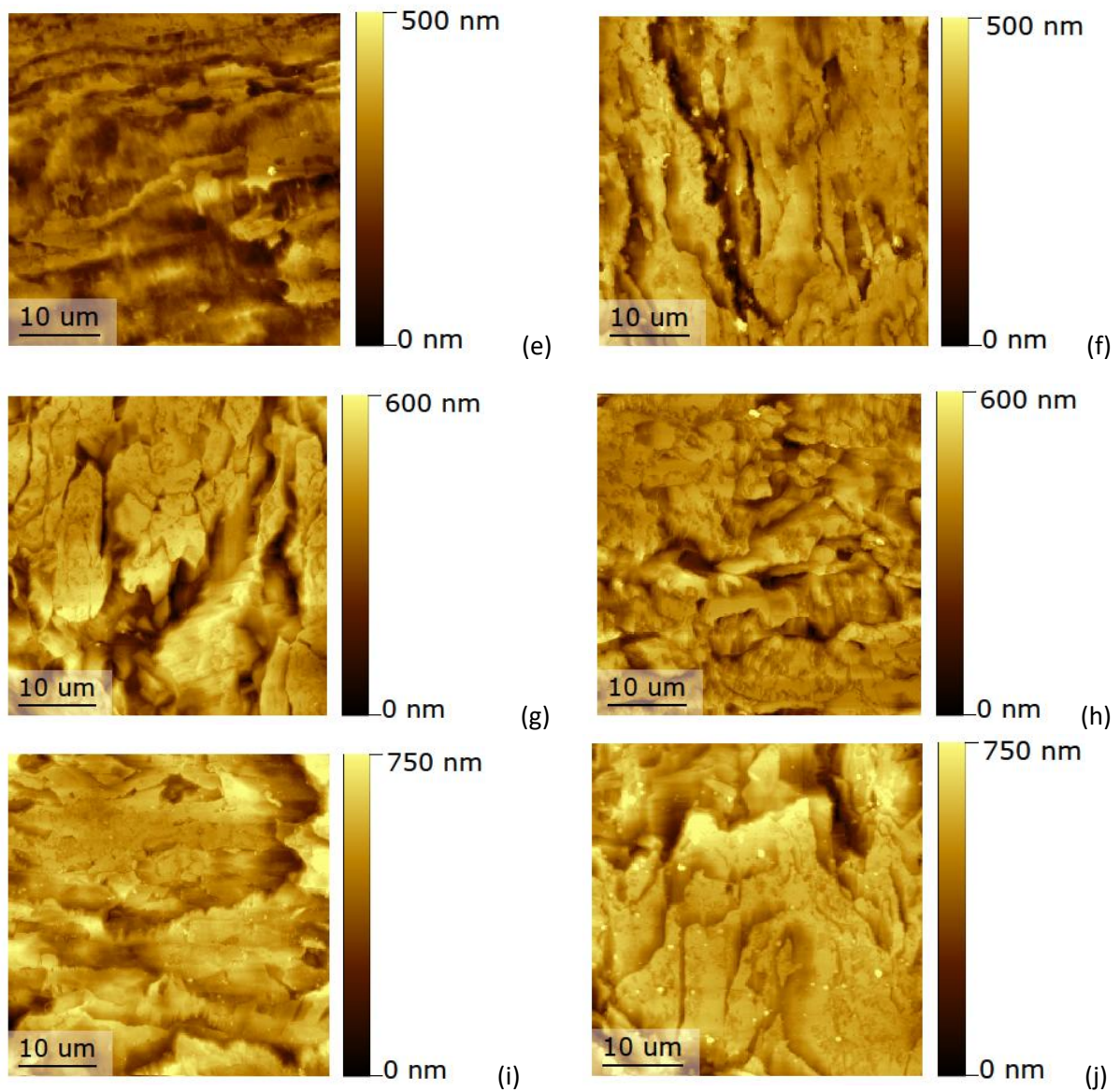
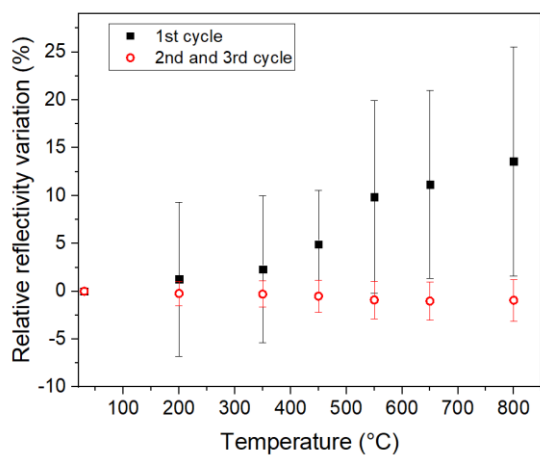


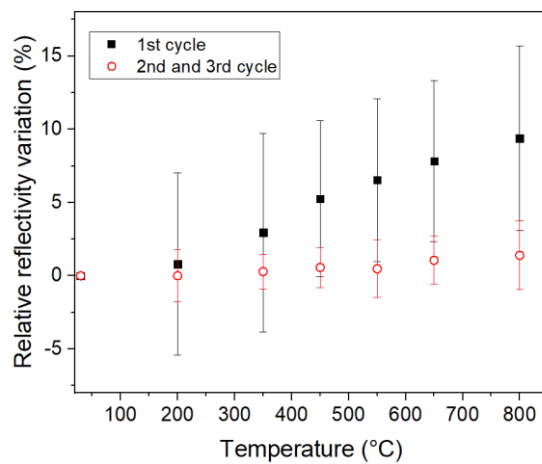
Figure S1. AFM images of samples W1 (a, b), W2 (c, d), W3 (e,f), W4 (g, h), W5 (i, j), before (left) and after (right) the annealings.

- **Evolution of reflectivity with temperature**

Figure S2 shows the relative variation of reflectivity with temperature (with respect to the room temperature curve) for the wavelengths 600 and 1000 nm. The increase is lower compared to the one obtained for 840 nm (shown in figure 3 of the article).



(a)



(b)

Figure S2. Relative reflectivity variation (with respect to room temperature measurement) at 600 nm (a) and 1000 nm (b) as a function of the samples temperature, during first annealing (black squares) and during second and third annealing (averaged, open red circles).