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SUPPL. MATERIAL

UV-VIS laser parameter effects on the physicochemical properties of Laser-Induced Graphene

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We conducted preliminary studies to determine the optimal software parameters for engraving. The experimental speed was calculated by measuring the time required for the laser to engrave a figure of known distance, then comparing it to the theoretical speed set in the software (**Supplemental Fig. 1a**). We examined laser focus (measured in mm) and engraving quality (lines per mm) to assess their impact on the LIG process, as uniform surface fabrication is crucial for maintaining electrical conductivity (Supplemental Fig. 1b and Supplemental Fig. 1c).

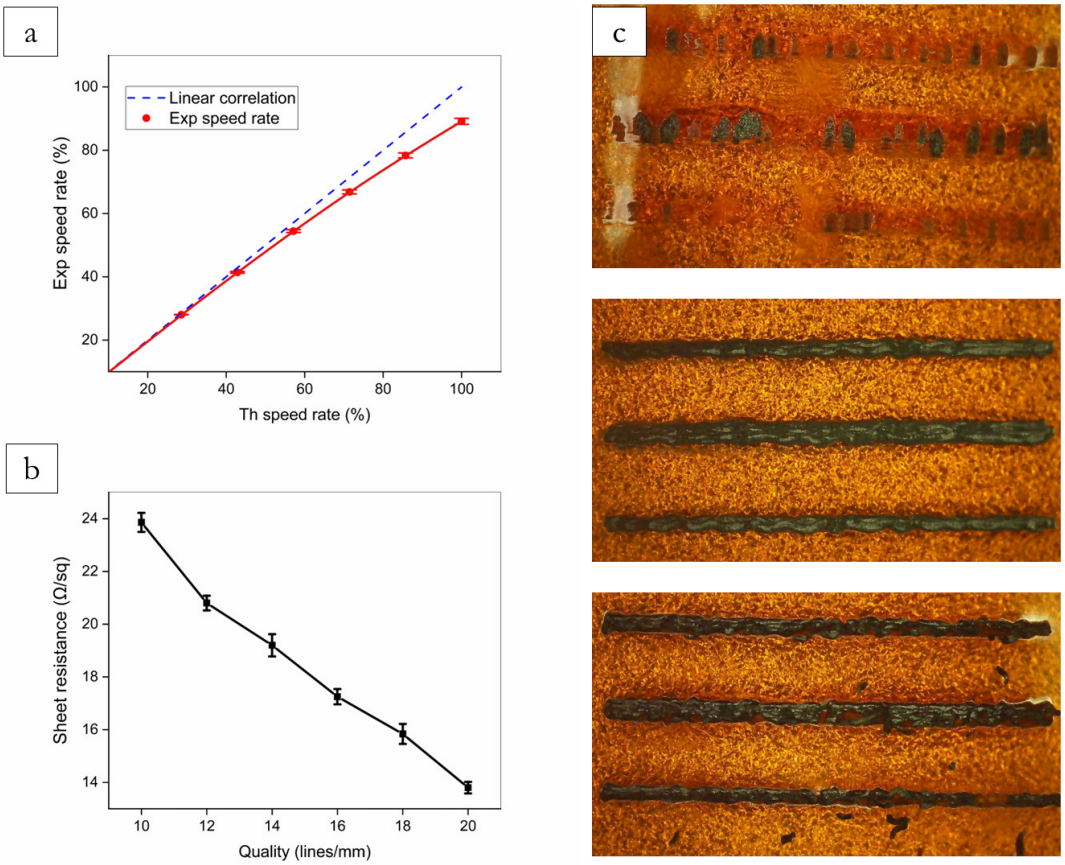

Figure 1. CNC structure and laser characterization: (**a**) Theoretical speed rate vs experimental speed rate, (**b**) sheet resistance vs quality, (**c**) overlap of engraving points and representation of the laser focus at 4.5 mm, 5 mm, and 5.5 mm.

As shown in Supplemental Fig. 1a, we observed that the maximum velocity could only be achieved up to approximately 91 % of the theoretical speed. Beyond this threshold, mechanical vibrations were introduced, leading to erratic or interrupted movements of the setup, and resulting in inconsistencies in the engraving process. We found that sheet resistance is inversely proportional to engraving quality and a higher number of lines per millimeter creates a more uniform surface, facilitating improved electrical conduction. The analysis of micrographs of the engraved lines and the behavior of laser focus was conducted to define the necessary parameters for ensuring precise point overlap.

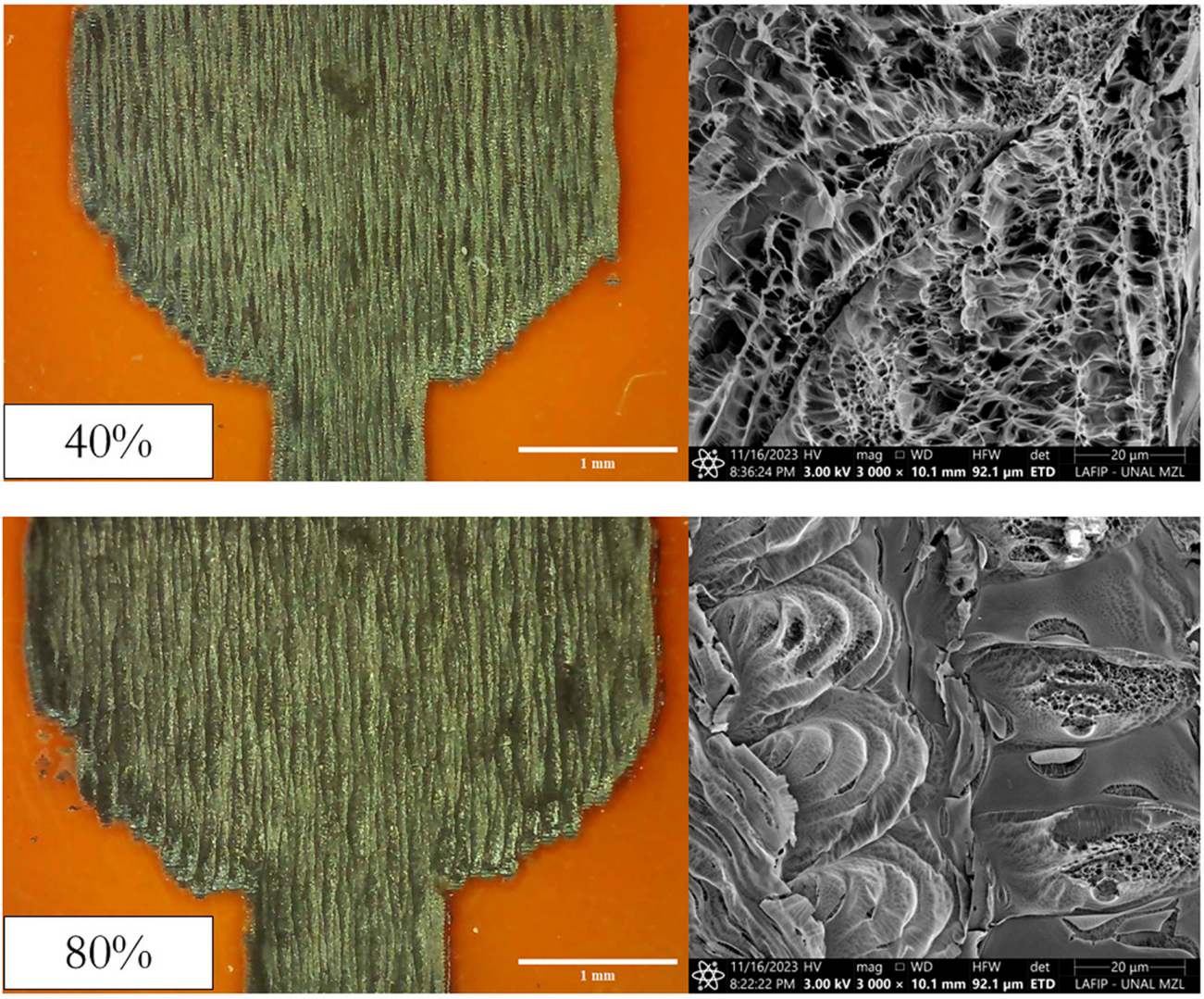

Figure 2. Morphological properties of LIG. Optical and SEM images showing the different morphologies of LIG.

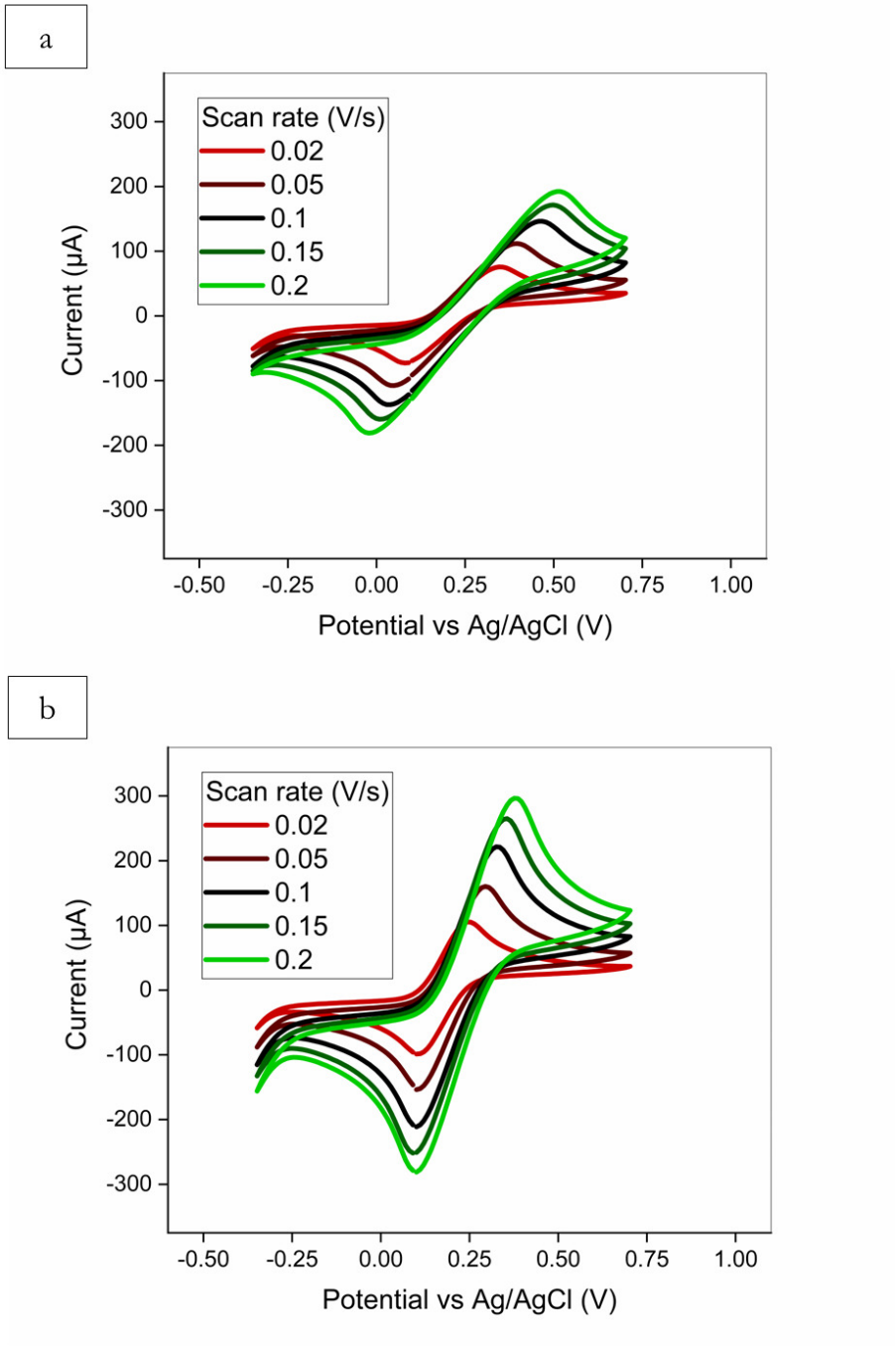

Figure 3. Cyclic voltammograms for (**a**) LIG40 and (**b**) LIG80.