Novel Graphene-Based Materials as a Tool for Improving Long-Term Storage of Cultural Heritage

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The Raman spectrum of GO (Figure S1A) comprises several frequency bands, each one assigned to a certain structural configuration[25]. The main Raman peak is the so-called G peak, located at 1580 cm^{-1} and is related to the E_{2g} mode and the in-plane stretching of C=C bonds. The most prominent "disorder" Raman peak is the so-called D peak, appearing at about 1360 cm^{-1}, is related to the hexagonal ring breathing mode, the intensity of which is associated with the presence of either structural defects or the crystal edges of the lattice [28]. The 2D peak at 2680 cm^{-1} is the second-order overtone of the D peak, which requires two-phonon scattering for activation, while the other two peaks at ~2950 cm^{-1} and ~3100 cm^{-1} correspond to the overtone of the D and G peaks and the G peak, respectively [29]. The two main Raman peaks of GO (G and D) are very sensitive to small changes in the sp^3/sp^2 ratio. Additionally, the intensity ratio of these two peaks, I_D/I_G, is correlated with the changes of the sp^3/sp^2 ratio and can be used for the characterization of GO. By analyzing a sufficient number of the Raman spectra, the intensity ratio I_D/I_G for the GO was found to be 0.97 ± 0.01.

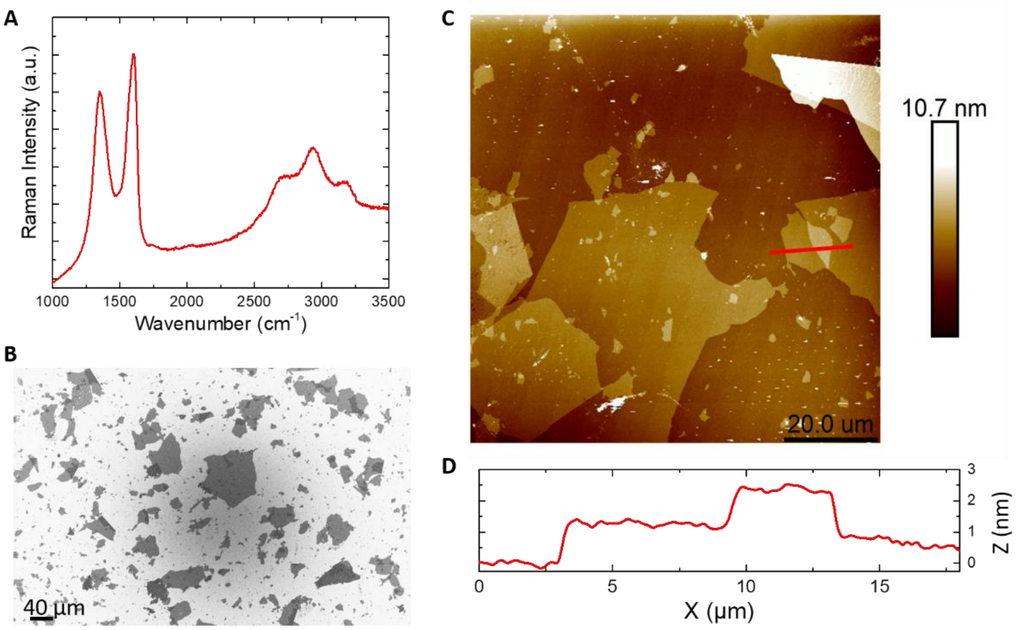

Figure S1. (**A**) Raman spectrum of produced GO, (**B**) SEM photo for GO sheets, (**C**) Atomic Force Microscopy (AFM) images of single-layer GO flakes, and (**D**) height profile of the GO flakes with a thickness of 1.25 nm.

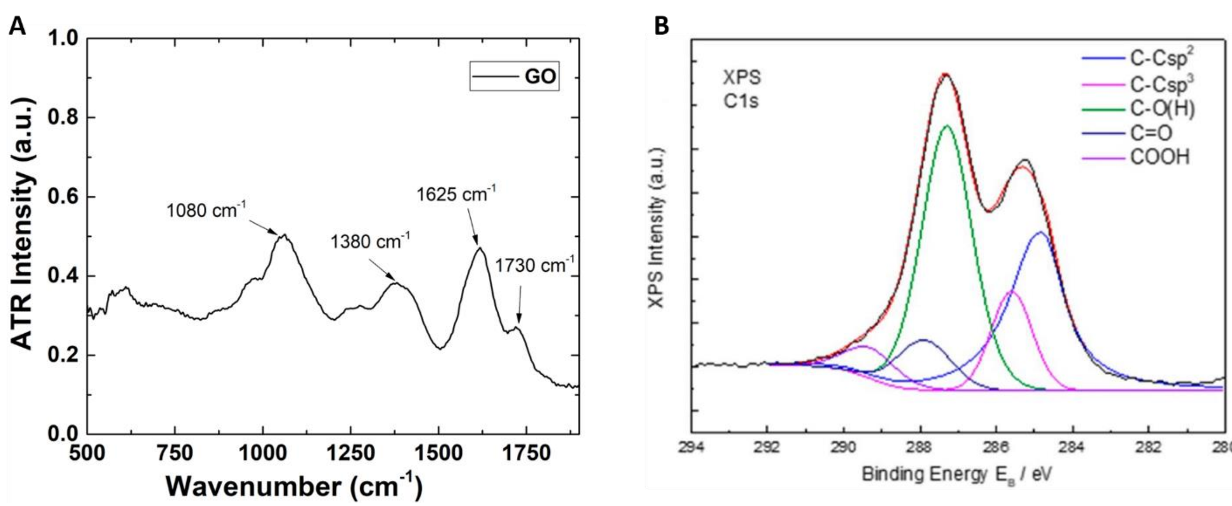

Figure S2. Spectroscopic characterization of GO by (**A**) ATR spectrum [4], and (**B**) XPS [5].

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