

Supporting Information for

Cu oxidation kinetics through graphene and its effect on electrical properties of graphene

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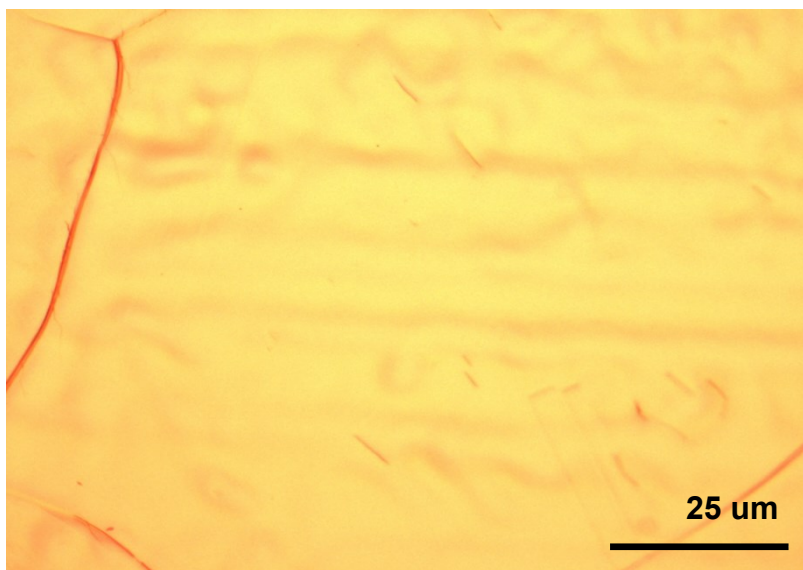
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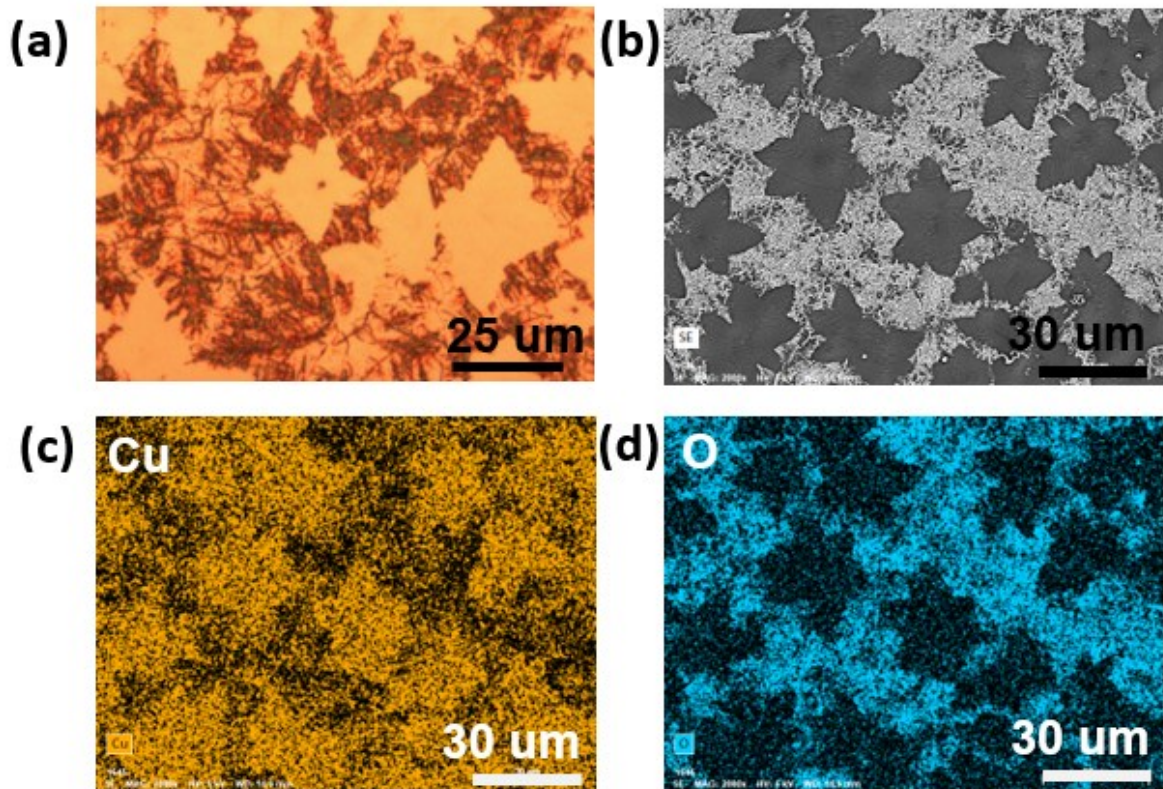
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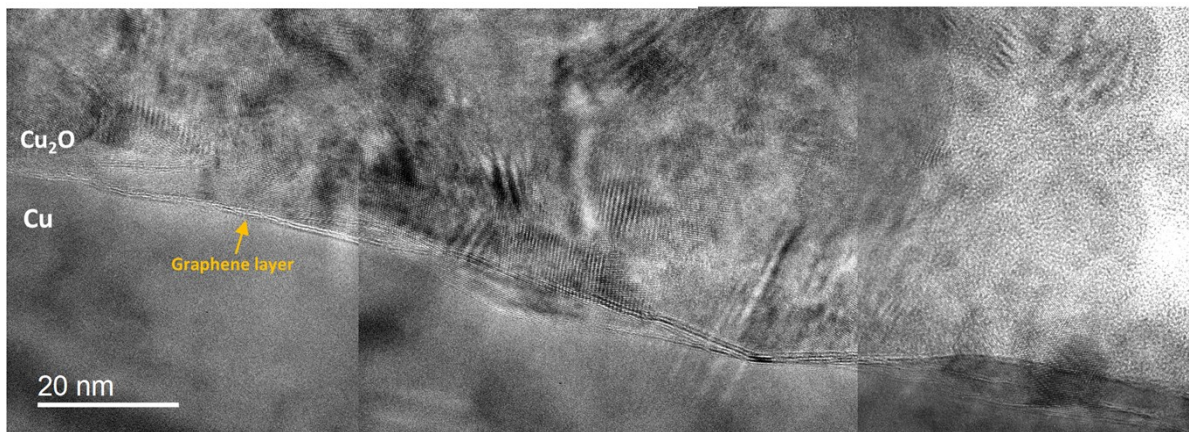
Supplementary S- I . Optical microscope image of as-grown single-layer graphene on Cu foil.

Except for the Cu grain boundaries, there is no optical contrast observed as graphene defects.

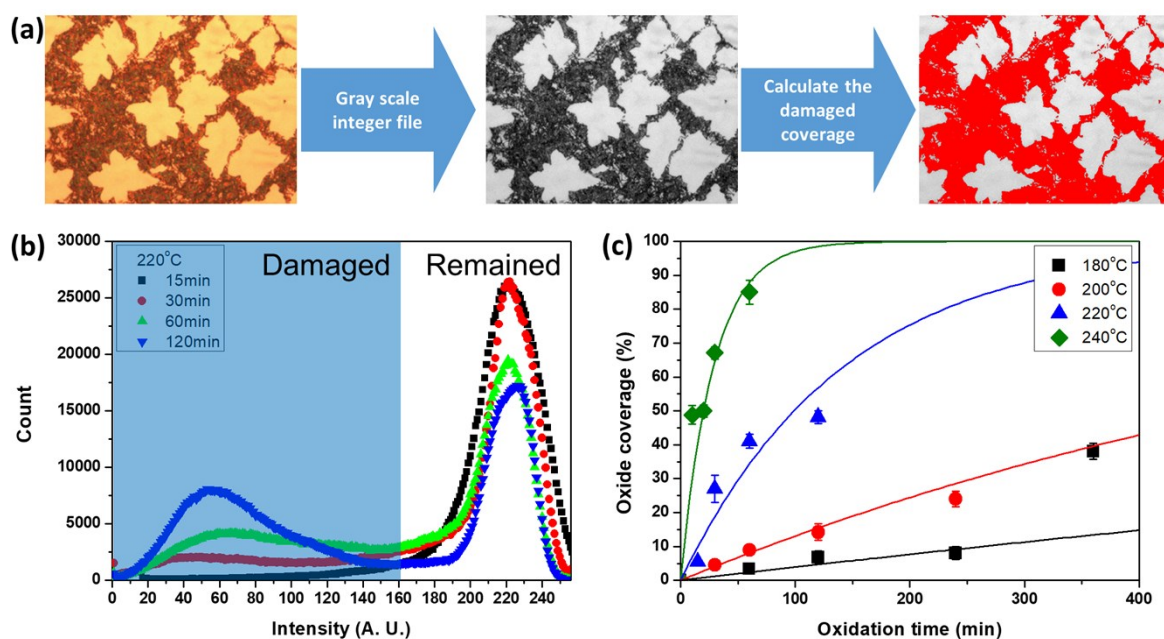


Supplementary S-II. (a) Optical microscopy image and (b) SEM image of sample oxidized at 220 °C for 1 hour. EDS mapping image of (b), representing Cu (c) and O (d) element, respectively.

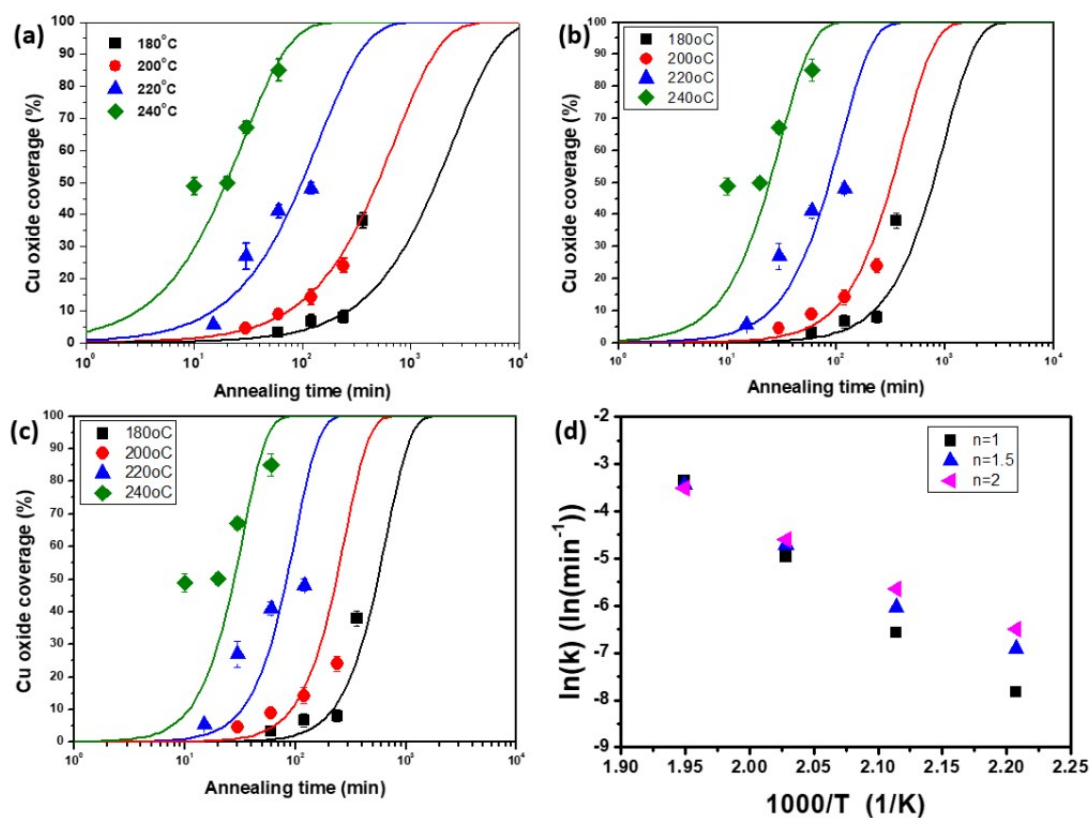
SEM and EDS analysis were conducted to identify the dark contrast in Fig. S-II (a). The dark contrast corresponds to the white contrast in SEM image in Fig. S-II (b). The EDS mapping result shows that the white contrast in SEM image consist of Cu and O element, otherwise, dark area in SEM image is solely composed of Cu element. This means that white contrast in SEM has the Cu oxide phase, and dark contrast has only Cu phase.



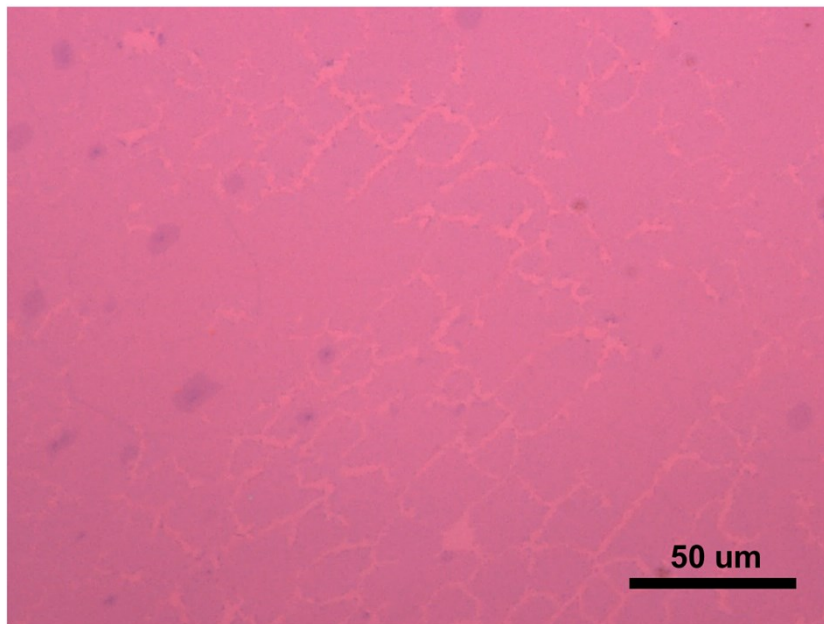
Supplementary S-III. Cross-sectional HRTEM image at the interface between Cu and Cu₂O



Supplementary S-IV. (a) RGB colored optical image file is converted to an integer file with 256-gray scale. (b) The count of damaged pixels is extracted from the intensity histogram and (c) it is divided by the total number of pixels to obtain the oxide coverage.



Supplementary S- V . JMAK fitting for various n value. (a) n=1, (b) n=1.5, (c) n=2. (d) Oxidation reaction constant as a function of $1/T$ for various n value. The activation energies were calculated as 1.54, 1.15 and 1.00 eV, respectively. It is confirmed that the fitting result is most well matched in n=1 and the activation energy also most similar to that of reported value at the n=1.



Supplementary S-VI. Optical image of graphene transferred to SiO₂/Si substrate

Supplementary S-VII. We attached separate moving image