

# Characteristic of defect generated on graphene through pulsed scanning probe lithography

Jhe-Wei, Liou

W. J. Huang, W. Y. Woon  
Department of Physics,  
National Central University, Jungli 32054, Taiwan  
[roy810791@gmail.com](mailto:roy810791@gmail.com)

Graphene has attracted attention in recent years because of the low dimensional and high electron mobility characteristics. However, the gap-less feature around the Dirac point sets an obstacle for further application. Defect generation is one way to manipulate the band gap of graphene.

Scanning probe lithography (SPL) is a well-developed nano-meter scale technique to create defect on graphene [Figure 1]. In our previously work, we formed graphene oxidation through negative bias SPL. However, the detail of the oxidation processing with scanning probe lithography is still unclear.

To understand this, we set up a pulsed scanning probe lithography system with precise pulse width and pulse treatment position control.

In low pulse density case, we can clearly distinguish each pattern made by each pulse through lateral force and topography microscopy simultaneously [Figure 2a].

Both of those two measurements conclude that pulsed SPL would generate some hole like defects with mean diameter of 160nm. Folding edges around holes can be observed by AFM. The above observation suggests that pulsed SPL produces ablation like process on graphene [Figure 2a]. The tapping phase measurement confirms that defect generation is independent on pulse width, indicating that the holes formation time is much shorter than the pulse width [Figure 2b], similar to a typical pulsed laser ablation process.

## References

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## Figures

Figure 1: Scanning probe lithography

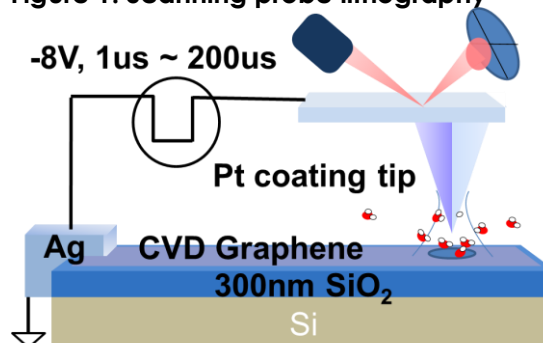


Figure 2: Surface measurement

