

Graphene visualized

Graphene is at the atomic limit of thinness: a single layer of crystalline, hexagonally bonded carbon. Yet real-world samples usually contain defects, which are challenging to visualize. For graphene layers grown on or transferred to a transparent substrate, conventional light microscopy achieves an image contrast of only 2%. Ke Xu and his group at the University of California, Berkeley, have developed a new visualization approach based on interference reflection microscopy (IRM), a label-free optical technique originally developed for cell biology. When applied to graphene on a transparent substrate, the technique can distinguish layers with a contrast greater than 30%

and allows *in situ* monitoring at up to 100 frames per second.

This image, generated by IRM using filtered green light from a broadband lamp, shows a $62\text{ }\mu\text{m} \times 77\text{ }\mu\text{m}$ section of a graphene layer grown by chemical vapor decomposition and deposited on glass. Voids (white regions), cracks (white lines), wrinkles (thin dark lines), and folds (dark regions) are among the nanoscale defects that are readily seen. Better characterization and monitoring of such defects should help advance commercial applications of graphene in transparent and flexible electronics. (W. Li et al., *Nano Lett.* **16**, 5027, 2016. Image submitted by Wan Li and Ke Xu.)

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