



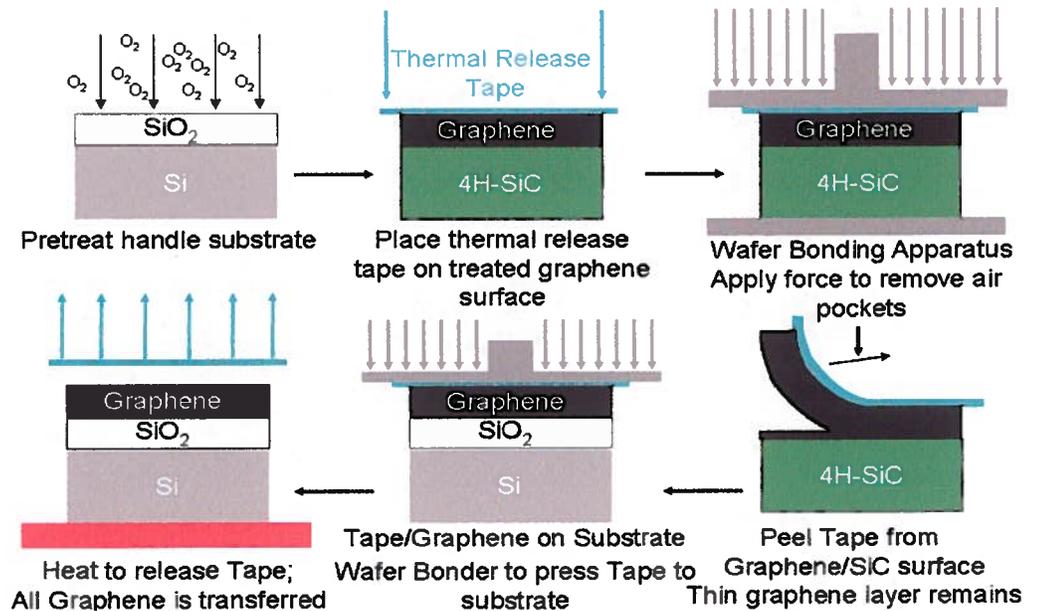
NAVAL RESEARCH LABORATORY

The Corporate Laboratory for the Navy and Marine Corps

Graphene Films and Methods for Transfer

The US Naval Research Laboratory (NRL) has developed an innovative technique to transfer graphene sheets from one substrate to another via the use of thermal release tape. The technique enables clean and crackless graphene transfer for large scale device production. The size of the graphene film transferred is limited only by the available dimensions of the transfer tape.

The NRL approach is amenable to use on a variety of handle substrates as appropriate for the specific device application. The flexibility of the approach has been demonstrated through the transfer of large-area epitaxial graphene films from C-face SiC donor substrates to SiO₂ on Si, p- and n-type metal organic chemical vapor deposition (MOCVD) GaN, and thin atomic layer deposition (ALD) Al₂O₃ handle substrates



The US Navy has developed a dry process technique (above) to transfer large areas of graphene films to a variety of handle substrates

Advantages and Opportunities

- Large-Scale Graphene Transfer: Size is limited only by the available dimensions of the commercially-available thermal release tape
- High Quality Films: Dry removal helps eliminate issues with wrinkling, folding, or tearing of the graphene films; no additional holes are introduced in the material
- Versatile: Compatible with a variety of handle substrates for use in flexible electronics, optically transparent contacts, and other advanced devices

Licensing and Collaboration Opportunities

U.S. Patent No. 8,753,468 is available for License to companies with commercial interest. Collaborative research and development is available under a Cooperative Research and Development Agreement (CRADA).