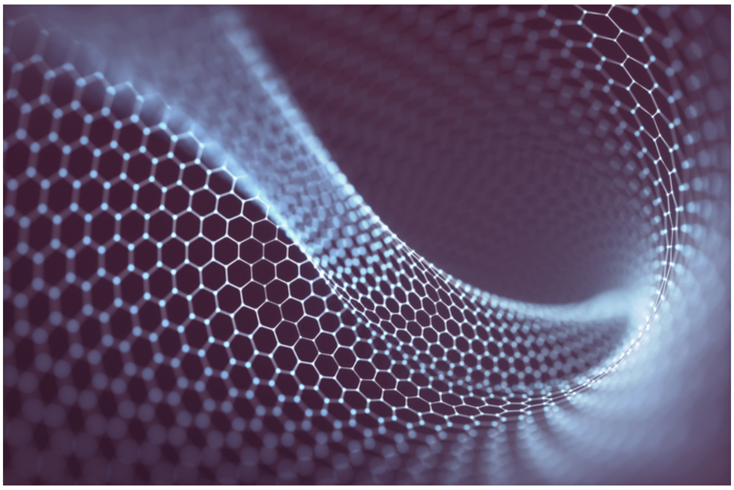
# Wafer Scale Bilayer Graphene Film Synthesis Technology

**TECHNOLOGY NUMBER: 4754**



## OVERVIEW

Scalable production method for large-area bilayer graphene films.

- Eliminates stacking steps, produces large, uniform bilayer graphene.
- Wafer-scale graphene electronics and photonics.

## BACKGROUND

Graphene has been hailed as a revolutionary material for post-silicon electronics due to its exceptional electrical, thermal, and mechanical properties. Traditional silicon-based electronics face challenges in scaling down and improving performance, leading researchers to explore alternative materials like graphene. Single-layer graphene, while promising, is intrinsically a semi-metal and requires intricate methods to introduce an energy bandgap. Historically, most bilayer graphene samples were produced via mechanical exfoliation, but this method is limited by the microscopic size of the samples, rendering it non-scalable. Recent advancements in chemical vapor deposition (CVD) have allowed for the synthesis of large-scale single-layer graphene, yet producing uniform bilayer graphene at a wafer-scale remains a significant challenge. Therefore, there is a critical need for an improved method to produce larger, uniform bilayer graphene films more efficiently and scalably.

## INNOVATION

**Technology ID**
4754

**Category**
Manufacturing Process
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

**Inventor**
Zhaohui Zhong
Seunghyun Lee
Kyunghoon Lee

**Further information**
Joohee Kim
jooheek@umich.edu

**View online**

The University of Michigan researchers have developed an innovative method for producing uniform multilayer graphene films greater than a square centimeter in size using a single CVD process. This approach eliminates the need for stacking multiple monolayers, significantly streamlining the production process. The produced bilayer graphene achieved more than 99% coverage, verified through spatially resolved Raman spectroscopy. Electrical transport measurements on dual-gate bilayer graphene transistors demonstrated a high success rate of field-induced bandgap tuning, observed in at least 98% of the devices. This method circumvents the limitations imposed by traditional exfoliation techniques, allowing for the scalable synthesis of wafer-sized bilayer graphene films. Potential real-world applications include the development of advanced graphene-based electronics and photonics, promising enhanced device performance and new technological possibilities.

## ADDITIONAL INFORMATION

INTELLECTUAL PROPERTY:

US10886126 "Uniform multilayer graphene by chemical vapor deposition"