Shaping atomically thin materials in suspended structures

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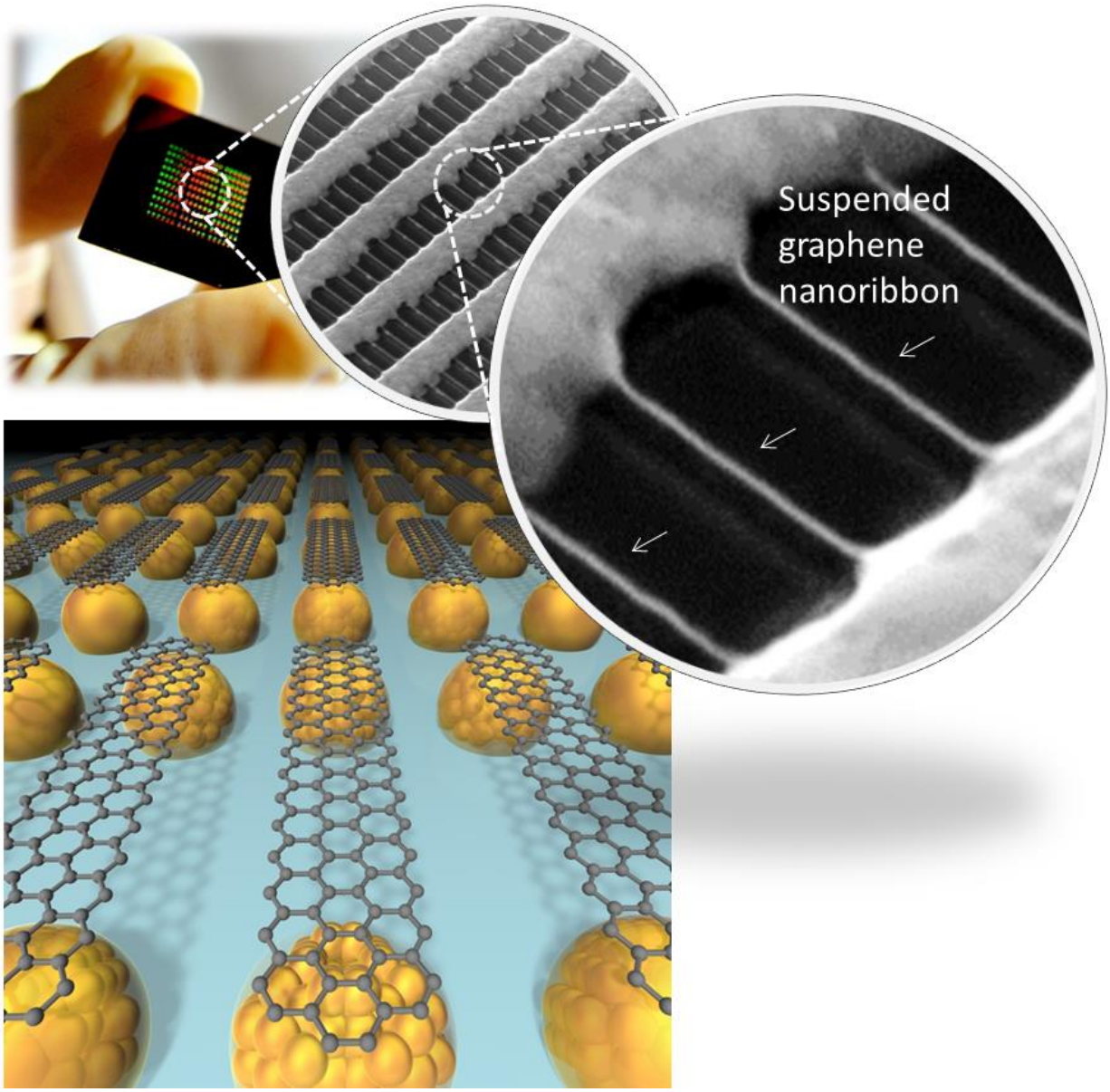

Suspended graphene nanoribbons in wafer-scale. Credit: Toshiaki Kato

Researchers at Tohoku University have realized wafer-scale and high yield synthesis of suspended graphene nanoribbons. The unique growth dynamic has been elucidated through comparing experiments, molecular dynamics simulations and theoretical calculations made with researchers from the University of Tokyo and Hokkaido University.

Adding a mechanical degree of freedom to the electrical and optical properties of atomically thin materials can provide an excellent platform to investigate various optoelectrical physics and devices with mechanical motion interaction. The large scale fabrication of such atomically thin materials with suspended structures, remains a challenge.

Led by Associate Prof. Toshiaki Kato, the team has used a bottom-up approach to demonstrate wafer-scale, high-yield synthesis of suspended graphene nanoribbon. This method has shed light on growth dynamics. It is possible to integrate over 1,000,000 suspended graphene nanoribbons in wafer-scale substrate with a high yield of over 90 %.

"Shaping atomically thin materials in suspended structures may provide a viable platform for nanoscale mechanical oscillators," says Kato.

Graphene nanoribbons are strips of graphene with quasi 1D structure (width ~ a few tens nm, length, ~ few μm). Different from 2D graphene, graphene nanoribbon includes band gap depending on its width and edge structures. It is expected to be utilized in next generation high performance optoelectrical semiconductor applications.

Kato adds, "The actualization of high yield and wafer-scale synthesis of suspended graphene nanoribbon will have an impact on the study of

graphene nanoribbon, and be used in practical applications in a wide variety of fields."

Details of this study were published online on June 2 in *Nature Communications*.

More information: Hiroo Suzuki et al, Wafer-scale fabrication and growth dynamics of suspended graphene nanoribbon arrays, *Nature Communications* (2016). DOI: 10.1038/ncomms11797

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