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# Controllable growth of graphene nanoribbon by advanced plasma chemical vapor deposition

**Toshiaki Kato, Toshiro Kaneko and Rikizo Hatakeyama**
Department of Electronic Engineering, Tohoku University, Japan

An advanced plasma chemical vapor deposition (CVD) method has outstanding advantages for the structural-controlled growth and damage-free functionalization of nano carbon materials such as carbon nanotubes (CNTs) and graphene. Graphene nanoribbons combine the unique electronic and spin properties of graphene with a transport gap that arises from quantum confinement and edge effects. This makes them an attractive candidate material for the channels of next-generation transistors. Nanoribbons can be made in a variety of ways, including lithographic, chemical and sonochemical approaches, the unzipping of carbon nanotubes, the thermal decomposition of SiC and organic synthesis. However, the reliable site and alignment control of nanoribbons with high on/off current ratios remains a challenge. We have developed a new, simple, scalable method based on the advanced plasma CVD method for directly fabricating narrow (~23 nm) graphene nanoribbon devices with a clear transport gap (58.5 meV) and a high on/off ratio (>$10^4$). Since the establishment of our novel graphene nanoribbon fabrication method, direct conversion of a Ni nanobar to a graphene nanoribbon is now possible. Indeed, graphene nanoribbons can be grown at any desired position on an insulating substrate without any post-growth treatment, and large-scale, two- and three dimensional integration of graphene nanoribbon devices should be realizable, thereby accelerating the practical evolution of graphene nanoribbon-based electrical applications.

## Biography

Toshiaki Kato has completed his Ph.D from Tohoku University, Japan, in 2007. He was a visiting researcher at Stanford University from 2008 to 2009. He joined the faculty of the Tohoku University where he is currently an assistant professor of Electrical Engineering. His research interests have ranged from synthesis to electro-device application of nanocarbon materials such as carbon nanotubes and graphene.

kato12@ecei.tohoku.ac.jp