Synthesis of multi-layer graphene on epitaxially-grown metal catalyst film and its electrical properties

Daiyu Kondo1, Haruhisa Nakano1, Bo Zhou1, Ichiro Kubota1, Junich Yamaguchi1, Kenjiro Hayashi1, Shintaro Sato1, and Naoki Yokoyama1

1 Collaborative Research Team Green Nanoelectronics Center (GNC), AIST (kondo.daiyu@aist.go.jp)

Nano-carbon materials including graphene are a candidate for new wiring materials for the future LSIs due to their excellent electrical properties [1]. Among nano-carbon materials, we focus on multi-layer graphene, and its application to LSI interconnect is discussed in this study. Recently, results regarding multi-layer graphene wiring obtained by chemical vapor deposition (CVD) or a related growth method have been reported [2, 3]. Although high-quality graphene is necessary for LSI interconnect, the electrical resistivity of graphene obtained by CVD is usually worse than that of highly oriented pyrolytic graphite (HOPG) by more than one order of magnitude due to its poor crystallinity. To solve this problem, we employed an epitaxial cobalt film to grow high-quality multi-layer graphene by thermal CVD method. A cobalt (Co) catalyst film with a thickness of 200 nm was deposited on a sapphire substrate by the conventional sputtering method at 500 degree C. Multi-layer graphene was then grown on the Co film by CVD at 1000 degree C using CH4 diluted by H2/Ar as the source gas. After synthesis, the multi-layer graphene obtained was evaluated by Raman spectroscopy. Raman spectra suggest that high-quality multi-layer graphene with the AB-stacked structure was synthesized. The measurement of electrical properties was then performed at room temperature. It was found that the resistivity of the multi-layer graphene was as good as that of HOPG. This research is granted by JSPS through FIRST Program initiated by CSTP. A part of this work was conducted at the Nano-Processing Facility, supported by IBEC Innovation Platform.