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マイクロ波プラズマ法によるポリイミドからのカーボンナノシート

Carbon Nanosheets Grown from Polyimide Film by Microwave Plasma Irradiation

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Carbon nanosheets (CNSs), which consist of few-layer graphene, have been extensively investigated in many application fields because of many open edges, high height/thickness ratio, large surface areas and chemical stability [1]. Depending on their synthesis approaches, the CNSs with different morphologies can be achieved and are classified into two categories-vertical and random alignments which relate to substrates [2]. Among the various synthesis methods for CNSs, plasma-enhanced chemical vapor deposition (PECVD) has been considered as a promising method for the formation of vertically-aligned CNSs because of mass production, large area, and low cost as well as low-temperature growth [3]. Usually, carbonaceous gas as carbon source was decomposed into carbon radicals under plasma irradiation, and carbon radicals would deposit on the substrate to form the CNSs with vertical orientation because of the local field effect [4]. Recently, besides carbon gas sources, some liquid organic precursors including honey, butter, and milk were used to fabricate the vertically-aligned graphene nanosheets by radio-frequency plasma treatments [5]. Our group employed the Ar/H_2 microwave plasma to generate vertical nanosheets with bi- and tri-layer of graphene from solid carbon source on the quartz tube [2].

In this work, we report the growth of vertically-aligned CNSs obtained on the Cu substrate from polyimide film (Kapton 500H/V) which is a solid carbonaceous polymer as carbon source under different plasma irradiations. Fig. 1 shows typical SEM and TEM images of the CNSs grown from polyimide by Ar/H_2 plasma radiation. The as-synthesized CNSs have been also characterized by energy-dispersive X-ray spectroscopy, X-ray photon spectroscopy, and Raman spectroscopy. The detailed results will be presented in the coming conference.

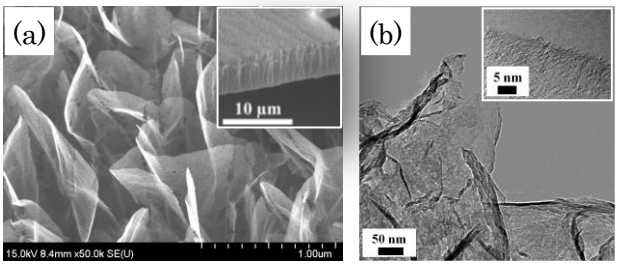

Fig. 1 (a) Typical SEM images of vertically-aligned CNSs on the Cu substrate from polyimide film as carbon source under Ar/H_2 plasma irradiation. Inset: Cross-sectional SEM image of vertically-aligned CNSs. (b) Typical TEM image of as-synthesized CNSs. Inset: TEM image of a five-layer graphene edge.

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