液中プラズマによる酸化錫–グラフェン複合体の合成

Liquid phase plasma assisted synthesis of Tin oxide – Graphene composite

名大院工[1]，名大未来社会創造機構[2] ○ランジット ボルーデ[1]，石川 健治[1]，堤 隆嘉[1]，近藤 博基[1]，堀 勝[2]

Nagoya Univ. Eng.[1], Nagoya Univ. Inst. Innovation for Future Society[2] ○Ranjit R. Borude[1], Kenji Ishikawa[1], Takayoshi Tsutsumi[1], Hiroki Kondo[1], Masaru Hori[2]

E-mail : borude.ranjit.rohidas@d.mbox.nagoya-u.ac.jp

1. Introduction

High-sensitive gas sensing applications of graphene are issued on selectivity [1]. Composites of tin oxide and graphene have been suggested to offer the selectivity due to formation of chemically functional groups and electronic p-n junction. The conventional synthesis methods are complex, expensive and time-consuming [2]. In this study, we have employed the in-liquid plasma synthesis method, which is a simple, low cost and high yields [3]. Successfully, it achieved to be synthesized tin oxide and graphene composites.

2. Experimental method

Fig. 1 (a) shows an experimental setup. Tin oxide was synthesized by sol-gel. The nanoparticulate tin oxide was then dispersed in ethanol. The in-liquid plasma (6 slm of Ar, 9 kV at 60 Hz) of the ethanol solution was treated for 30 min. Synthesized black precipitates were collected using a 1-μm filter membrane. After drying, we characterized using Raman spectroscopy, scanning electron microscopy (SEM) and Fourier transform infrared (FTIR).

3. Results and discussion

Fig. 1 (b) represents Raman spectra of the composites. The peaks around 500 cm^{-1} are assignable to tin oxide [4]. The other peaks located higher Raman shift are distinctively identified to graphene of G, 2D, D, and D` [5]. Fig. 1 (c) is the SEM image of composite. Flaky structured graphene and the tin oxide particles were uniformly distributed. The in-liquid plasma discharges assisted to form graphene flakes uniformly surrounding the nano-sized tin oxide particles. The simple, atmospheric pressure, room temperature operating and low cost liquid phase plasma assisted synthesis process for tin oxide-graphene composite is demonstrated.

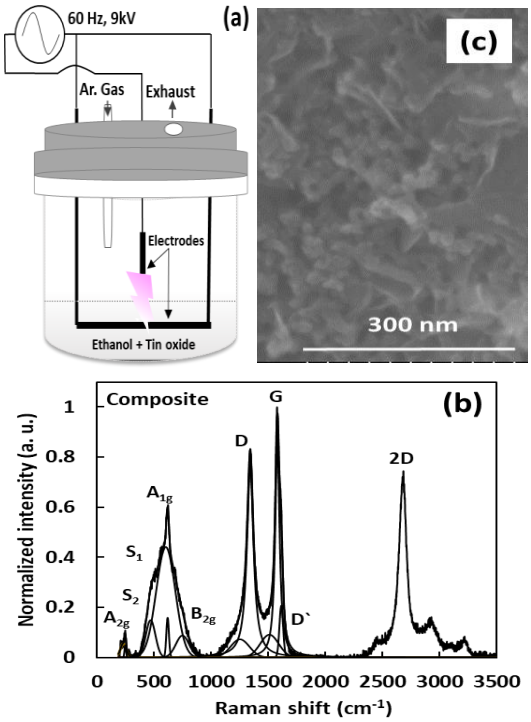

Fig. 1. (a) Schematic illustration of experimental apparatus, (b) Raman spectra, and (c) SEM image of the composite.

References

1. S. Varghese et al., Sensor. Actuator. B **218** (2015) 160.
2. S. Chatterjee et al., Sensor. Actuator. B **221** (2015) 1170.
3. T. Hagino et al., Appl. Phys. Express. **5** (2012) 035101
4. A. Dieguez et al, J. App. Phys. **90** (2001) 1550.
5. L. Cancado et al., Appl. Phys. Lett. **88**, (2006) 163106

© 2018年 応用物理学会