

Porous graphene structure for high performance field emitters

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Abstract

We report a highly productive method to fabricate a cylindrical foam of graphene field emitter based on electrophoretic deposition of GO. Simultaneous electrophoresis and electrochemical reduction allows us to fabricate rGO foam with a low potential (4 V) and very short process time (10 sec). A vacuum drying process enables the fabrication of highly porous rGO foam which involves numerous sharp edges suitable for field emission. The fabricated graphene foam emitter shows outstanding field emission properties, such as a low turn-on electric field of $1.6 \text{ V } \mu\text{m}^{-1}$, threshold field of $2.2 \text{ V } \mu\text{m}^{-1}$ and long-term emission stability with a current density of 8.1 mA cm^{-2} . The outstanding field emission characteristics are attributed to the unique two-dimensional atomic structure and superb electrical properties of graphene. Particularly, the atomically sharp edges in graphene highly focus electric field for electron emission, attributing to low threshold.[1] We envisioned that the present emitter is applicable to luminescent lighting tube and also provides a winding structure that requires high-current electron sources with high mechanical flexibility and robustness.

References

- [1] H. Yamaguchi, K. Murakami, G. Eda, T. Fujita, P. Guan, W. Wang, C. Gong, J. Boisse, S. Miller, M. Acik, K. Cho, Y. J. Chabal, M. Chen, F. Wakaya, M. Takai, M. Chhowalla, ACS Nano 2011, 5, 4945

Figures

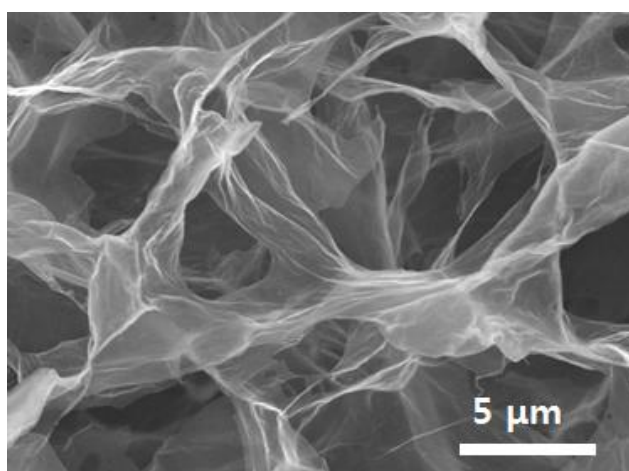


Figure 1: SEM image of rGO foams fabricated on a copper wire/plate

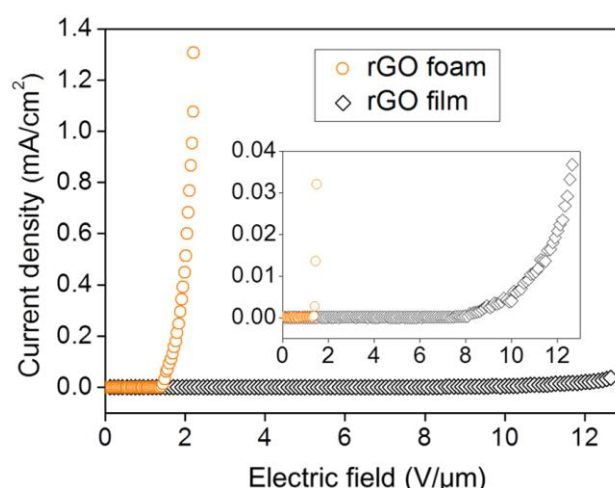


Figure 2: I-V characteristics of the emitters in a vacuum chamber at a base pressure of 3.0×10^{-7} Torr

