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## Eco-friendly preparation of large-sized graphene via short-circuit discharge of lithium primary battery

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**Abstract:** we proposed a large-sized graphene preparation method by short-circuit discharge of the lithium-graphite primary battery for the first time.  $\text{LiC}_x$  is obtained through lithium ions intercalation into graphite cathode in the above primary battery. Graphene was acquired by chemical reaction between  $\text{LiC}_x$  and stripper agents with dispersion under sonication conditions. The gained graphene is characterized by Raman spectrum, X-ray diffraction (XRD), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), Atomic force microscope (AFM) and Scanning electron microscopy (SEM). The results indicate that the as-prepared graphene has a large size and few defects, and it is monolayer or less than three layers. The quality of graphene is significantly improved compared to the reported electrochemical methods. The yield of graphene can reach 8.76% when the ratio of the  $\text{H}_2\text{O}$  and NMP is 3: 7. This method provides a potential solution for the recycling of waste lithium ion batteries.

**Keywords:** Electrochemical preparation; Graphite; Graphite intercalation compounds; Graphene

### Introduction

Graphene generally shows potential application prospect in many fields<sup>[1-5]</sup> such as catalysis,<sup>[6-7]</sup> biomaterials,<sup>[5][8-9]</sup> electronics<sup>[2-3][10]</sup> and supercapacitor<sup>[11-14]</sup> owing to its unique physical and chemical properties. Various processing methods<sup>[15-20]</sup> are

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