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Thermally Reduced Graphene Oxide for Hydrogen Storage

Abstract

Graphene is one of the most promising materials due to its remarkable properties. One of the noticeable features of graphene is its high specific surface area (2630 $m^2.g^{-1}$). This property is highly desirable for hydrogen storage applications (1-2), one of which main challenges is the production of graphene materials in large quantities.

Thermal treatments of graphite oxides have been promising methods for the mass production of reduced oxide graphene (rGO) with high specific surface areas (3).

In this study, we present a simple method for thermal reduced graphene production that can be used later for hydrogen storage.

Two different temperatures were probed (250º C and 450º C) in four different instruments: a) an electrical furnace under air conditions, b) microwaves under air conditions, c) a fusion instrument under air conditions, and d) a tubular reactor inside an electrical furnace. In the last case, a 100 $mL.min^{-1}$ Ar flow was used, and the reactor characteristics allowed the control of the heating rate.

Successful reduction of thermal reduced oxide graphene (T-rGO) samples was confirmed by elemental analysis and X-ray diffraction (XRD). These materials showed high specific surface areas, of about hundreds of $m^2.g^{-1}$ in the Brunauer, Emmett Teller (BET) test. The scanning electron microscopy (SEM) showed very porous structures.

This method does not require high-cost and long processing time and could be useful to make graphene materials in large quantities for industrial applications such as hydrogen storage.

References

[1] Guo CX, Wang Y, Li CM. ACS Sustainable Chemistry and Engineering, 1 (2013) 14

[2] Kim JM, Hong WG, Lee SM, Chang SJ, Jun Y, Kim BH, et al., Int. J. Hydrog. Energy, 39 (2014) 3799

[3] Nguyen ST, Nguyen HT, Rinaldi A, Nguyen NPV, Fan Z, Duong HM, Colloids and Surfaces A, 414 (2012) 352

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