Electronic Supplemental Information for

Directly bonded hybrid of graphene nanoplatelets and fullerene: facile solid-state mechanochemical synthesis and application as carbon-based electrocatalyst for oxygen reduction reaction

Jian Guan, Xiang Chen, Tao Wei, Fupin Liu, Song Wang, Qing Yang, Yalin Lu, and Shangfeng Yang*

Hefei National Laboratory for Physical Sciences at Microscale, CAS Key Laboratory of Materials for Energy Conversion, Department of Materials Science and Engineering & Synergetic Innovation Center of Quantum Information & Quantum Physics, University of Science and Technology of China (USTC), Hefei 230026, China

Contents

S1. Raman spectra of products with/without LiOH catalyst. [S2]
S2. O1s XPS spectrum of the graphene-C_{60} hybrid. [S2]
S3. TGA curve of the graphene-C_{60} hybrid in comparison with those of pristine graphite and C_{60}. [S3]
S4. Schematic illustration of the formation mechanism of the graphene-C_{60} hybrid via ball-milling. [S3]
S5. Raman spectra of the products obtained with different catalysts. [S4]
S6. HR-TEM images of the graphene-C_{60} hybrid taken at another site and the “blank” graphene nanoplatelets. [S4]
S1. Raman spectra of products with/without LiOH catalyst.

Figure S1. Raman spectra of products obtained from ball-milling of graphite and C\textsubscript{60} with LiOH catalyst (graphene-C\textsubscript{60} hybrid, curve a) and without LiOH catalyst (curve b).

Clearly, the characteristic Raman peak at 1458 cm\textsuperscript{-1} assigned to C\textsubscript{60} in the Raman spectrum of the graphene-C\textsubscript{60} hybrid is not observed in the Raman spectrum of the product obtained from ball-milling of graphite and C\textsubscript{60} without LiOH catalyst, revealing that graphene-C\textsubscript{60} hybrid did not form in this case.

S2. O1s XPS spectrum of the graphene-C\textsubscript{60} hybrid.

Figure S2. O1s XPS spectrum of the graphene-C\textsubscript{60} hybrid.
**S3. TGA curve of the graphene-C$_{60}$ hybrid in comparison with those of pristine graphite and C$_{60}$.**

![TGA curves](image)

Figure S3. TGA curves of pristine graphite (a), the graphene-C$_{60}$ hybrid (b), and C$_{60}$ (c). A dotted vertical line was added to aid identifying the last step (700 - 770 °C) related to the decomposition of C$_{60}$.

**S4. Schematic illustration of the formation mechanism of the graphene-C$_{60}$ hybrid via ball-milling.**

![Scheme S1](image)

Scheme S1. Schematic illustration of the formation mechanism of the graphene-C$_{60}$ hybrid via the mechanochemical ball-milling.
S5. Raman spectra of the products obtained with different catalysts.

Figure S4. Raman spectra of the products obtained from ball-milling graphite and C$_{60}$ with different catalysts of LiOH (a), KOH (b) or NaOH (c).

S6. HR-TEM images of the graphene-C$_{60}$ hybrid taken at another site and the “blank” graphene nanoplatelets.

Figure S5. HR-TEM images of the graphene-C$_{60}$ hybrid taken at another site different to that shown in Figure 5 (a) and the “blank” graphene nanoplatelets prepared by ball-milling pure graphite under identical conditions (b).