Electronic Supplementary Information

(ESI)

Microbial Oxidation of Dispersed Graphite by Nitrifying Bacteria 2011.2

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Experimental Section

Bacterial strains, culture, and reaction conditions. Natural flake graphite was purchased from Qingdao Zhongtian Company (Qingdao, China). To obtain the dispersive graphite suspension, 1 g pure graphite were dispersed in 100 mL of deionized water and sonicated for 2h, forming 1%(w/w) graphite suspension. Then 10 mL of 1% graphite suspension was introduced to a 200 mL nitration medium solution, forming 0.5mg/mL dispersed graphite suspension.

Nitrifying bacterial 2011.2 conserved by our laboratory was cultured in Luria-Bertain (LB) broth at 30℃ for 24 h in an incubator shaker with shaking at 150 r/min. Bacterial was inoculated into 1L Erlenmeyer flask containing 200 mL nitration medium ($(NH_4)_2SO_4$ 0.24g/L, sodium succinate 2.81g/L, Vickers salt solution 50 mL/L, pH 7.0) and 0.5mg/mL graphite suspension. The mixture was shaken at 150 r/min for about 5 days.

Preparation of microbial graphite oxide (MGO) and chemical graphene oxide (CGO). The samples were purified with the following sequences: deionized water, followed by a 30 min wash in 2 N HCl, deionized water, a 5-10 min wash in 80% ethanol and deionized water. The pure product was dried overnight in an vacuum drying oven at 60℃. As a control, chemical graphene oxide (CGO) was prepared using the modified Hummers′ method.

Characterization of MGO and CGO. Raman spectra of all the samples were achieved using a Renishaw Invia Raman Microprobe with a 514 nm argon ion laser. High-resolutionTransmission electron microscopy (TEM) analyses were conducted with a JEOL JEM2100F microscope. Samples for AFM imaging were prepared by drop-casting the dispersive MGO onto freshly cleaved mica substrates, which were then allowed to dry in air. The MGO samples were pressed before the X-ray photoelectron spectron (XPS) test. XPS were recorded on a RBD upgraded PHI-5000C ESCA system (Perkin Elmer) with Al Kα radiation (hυ=1486.6eV).

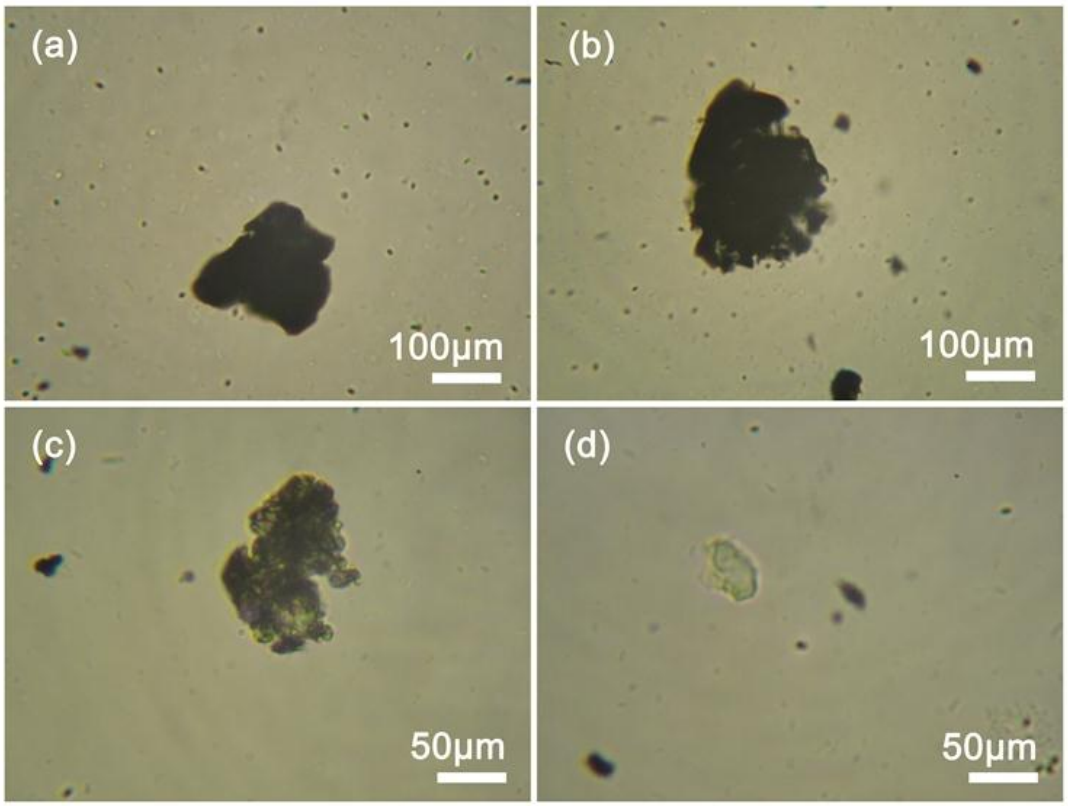

Figure S-1. Microscope photographs of graphite in a drop of nitration medium solution with nitrifying bacterial 2011.2. (a, the original dispersed graphite and the nitrifying bacterial 2011.2. b, a piece of graphite with fragmentized edges. c, the thinner and more transparent graphite with fragmentized edges. d, a piece of graphite sheets with high light transmission.)

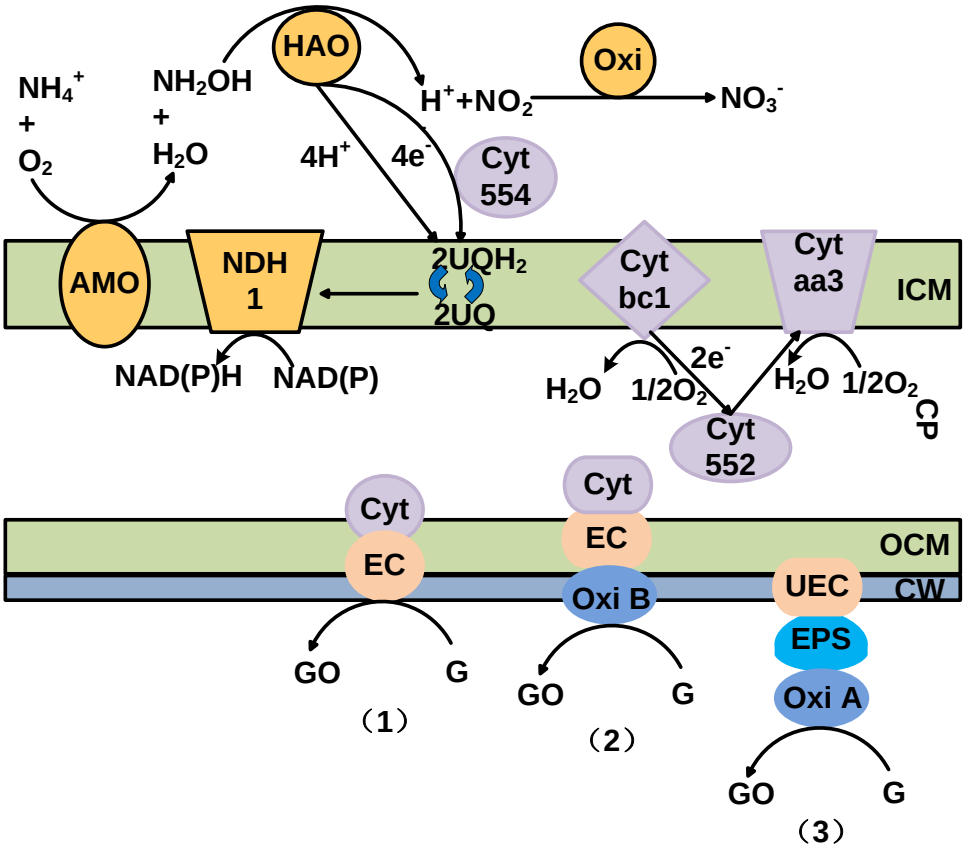

Figure S-2. Proposed mechanism of microbial oxidation of graphite by Nitrifying bacterial 2011.2. The scheme depicts the oxidation of one molecule of ubiquinol by the ammonia monooxygenase (AMO). The hydroxylamine is oxidized to nitrite by the hydroxylamine oxidase (HAO), generating four electrons and five protons. The four electrons generated transfer to cytochrome (Cyt) c554 and then, together with four protons, are used to reduce two molecules of ubiquinone into two molecules of ubiquinol.