Electronic Supplementary Information (ESI)

Novel method to synthesize luminescent silicon carbide nanoparticles based on dielectric barrier discharge plasma

Wenxi Yang,[a] Mingxia Sun,[a] Hongjie Song,[a] Yingying Su[b] and Yi Lv [a,b]*

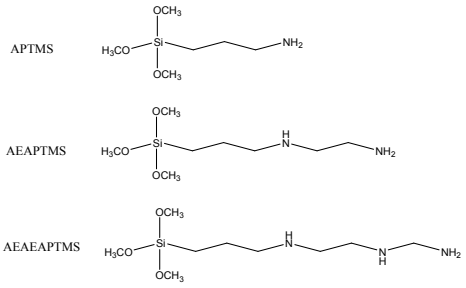
[a] Key Laboratory of Green Chemistry & Technology, Ministry of Education, College of Chemistry, Sichuan University, Chengdu, Sichuan 610064, China

[b] Analytical & Testing Center, Sichuan University, Chengdu, Sichuan 610064, China

TEM characterization

The morphology of SiC NPs was observed by TEM after been dialyzed with MWCO membrane of 1000D for 16 hours and dispersed by ultrasound in order to avoid the coating of APTMS. During the dialysis processes, the small nanoparticles would aggregate and form large particles, so it was obvious that large particles appeared around small ones showed in Fig 2b. Although the dialysis time was long enough, there were still some H_2O_2 and APTMS in the solution yet, and the white circles in the field were oxygen bubbles formed by H_2O_2.

The structures of amino silanes (precursors)



Detection of carbon dioxide

The clear limewater was added with APTMS or blank to see if there being CO2 produced here, for CO2 was the characteristic product of hydroxyl radicals and methanol. Since less carbon dioxide was produced, turbidity could be seen in the first 30 min DBD reaction after removing a large amount of supernatant by centrifugation (Fig S7).

Starch-KI test

The mechanism of fluorescence quenching by gold (III) ion on SiC NPs was studied. According to the redox reaction: $Au^{3+}+I^{-}=AuI+I_2$, the valence state of gold ions in the mixture was detected. As shown in illustration of Fig S8b, when drops of gold (III) ion solution were added to the starch-KI test paper, the test paper turns purple (top). When drops of mixed liquid after the reaction of gold (III) ion and SiC NPs were added to the test paper, no colour changed.

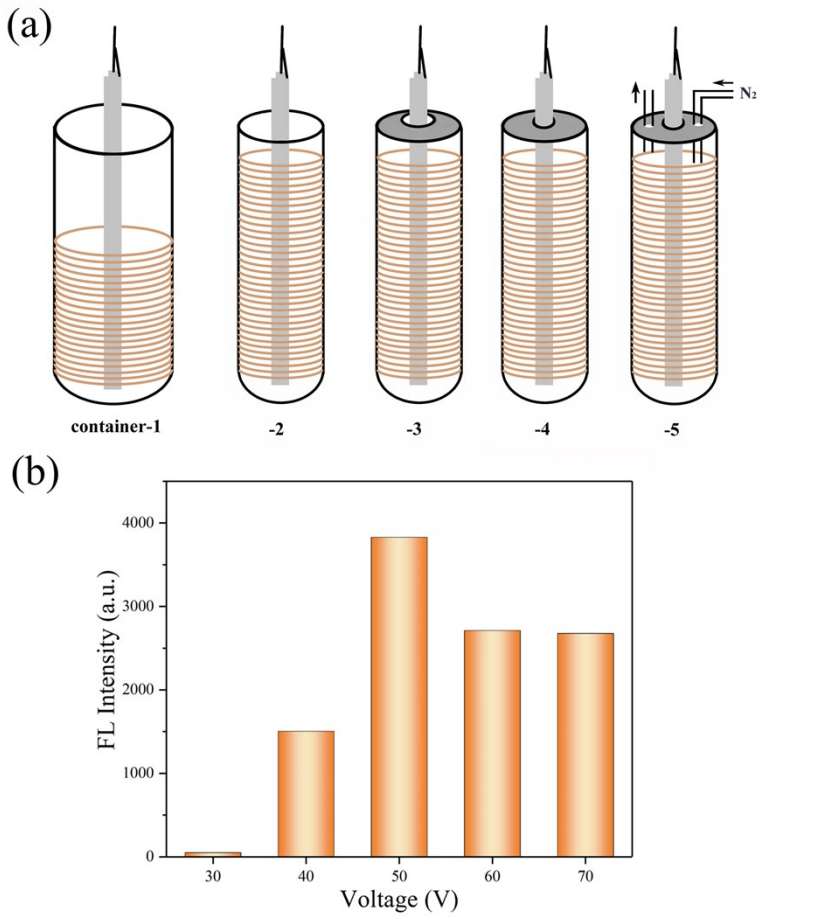


Figure S1. (a) Containers designs with different volumes and tops. (b) Effect of input voltage of DBD system on synthesis of SiC NPs

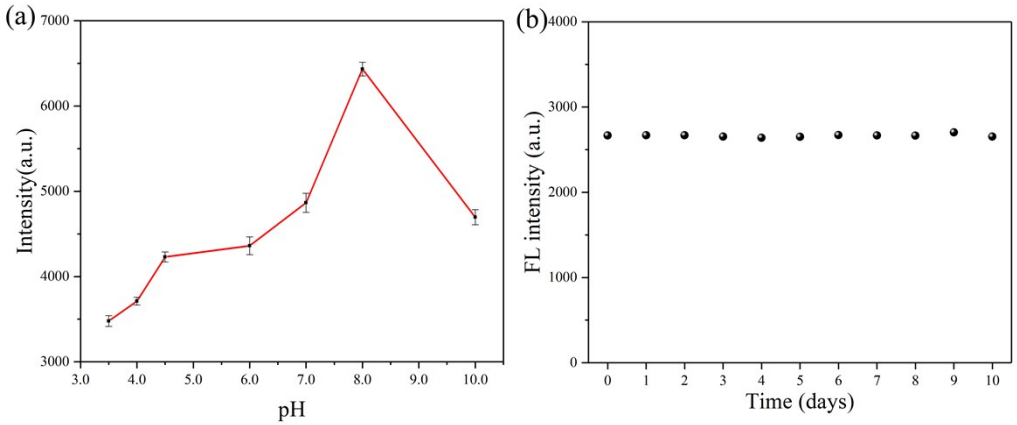


Figure S2. (a) The fluorescence intensity of SiC NPs in buffer solutions with different pH conditions from 3.5 to 10.0.(b) The chemical stability of SiC NPs stored at 4℃ in 10 days.

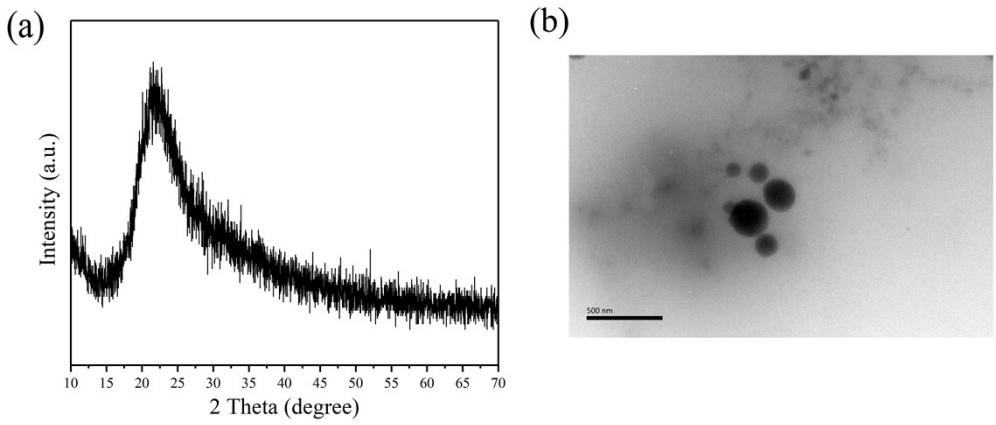


Figure S3. (a)XRD of SiC NPs solid obtained via ventilated drying from product solution. (b)TEM of overreacted SiC NPs.

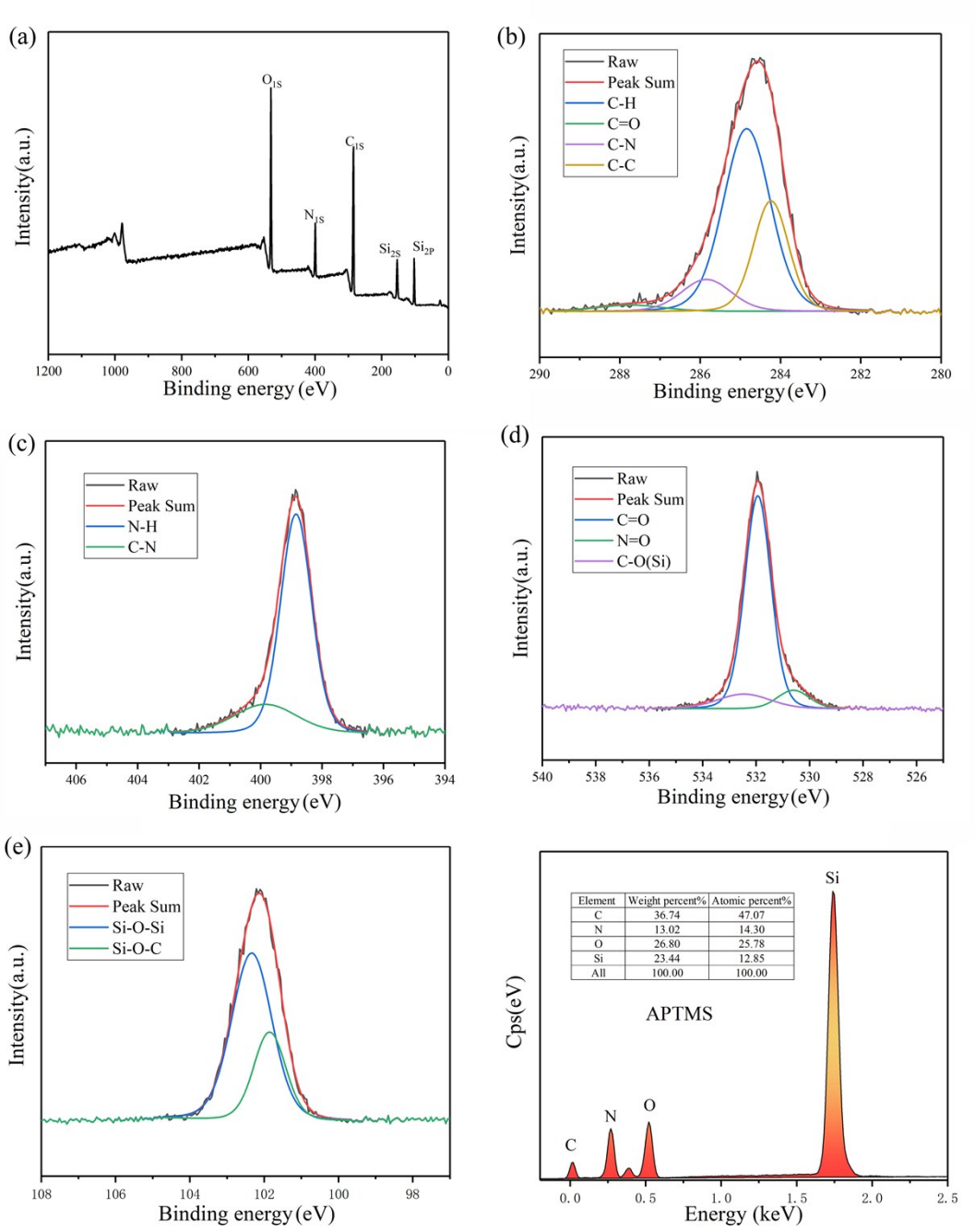


Figure S4. (a) XPS spectrum of SiC NPs, high-resolution XPS spectra of(b) C1s, (c) N1s, (d) O1s (e) and Si2p (f) EDS spectrum of APTMS.

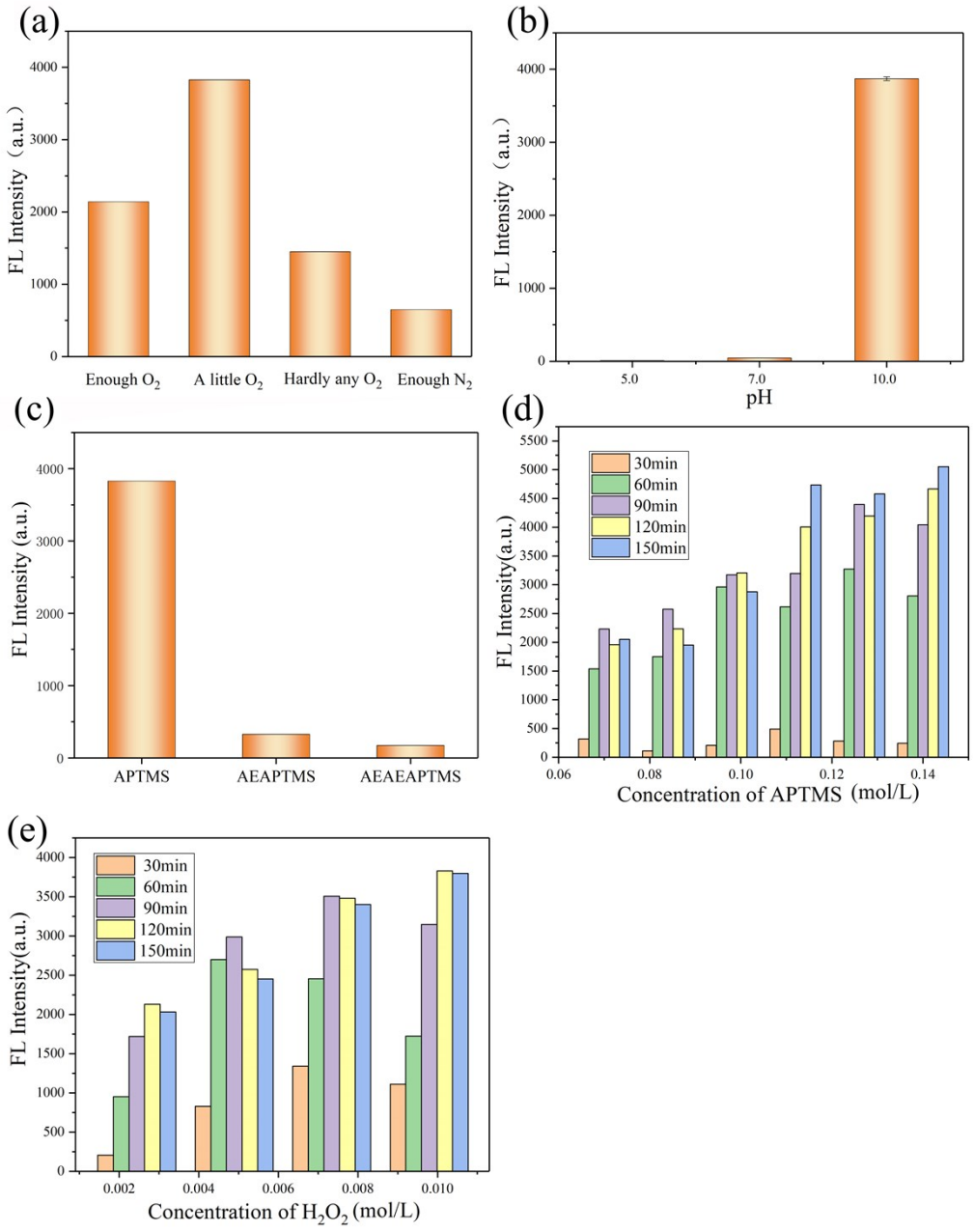


Figure S5. Influences of (a) oxygen content (b) pH (c) precursors (d) concentration of APTMS (e) and concentration of H_2O_2 on synthesis of SiC NPs.

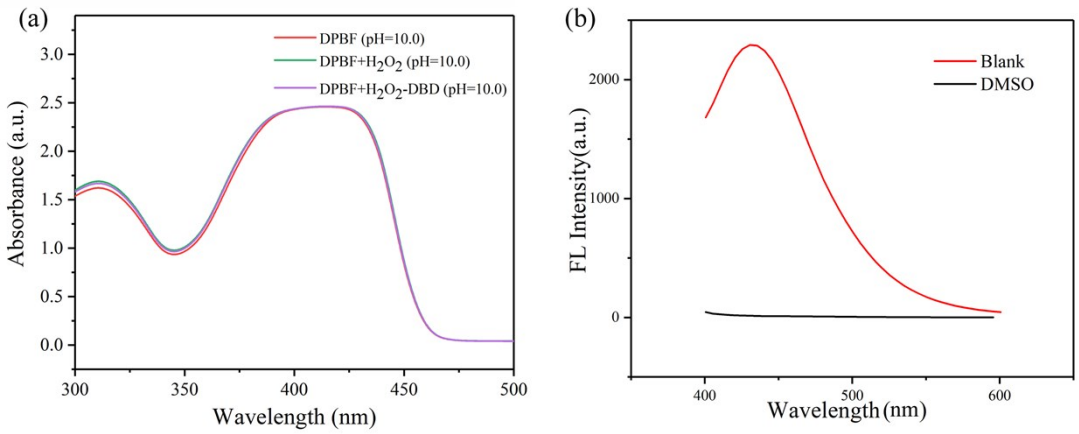


Figure S6. (a) UV-vis absorption spectra of DPBF as the probe of $^1O_2$. (b) Fluorescence intensity of the reaction solution with DMSO added.

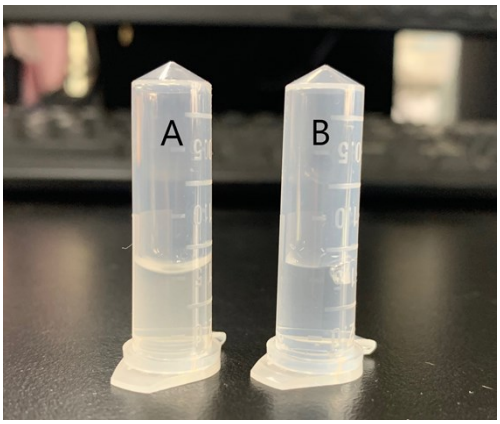


Figure S7. Image of clear limewater reacted with the product solution, in which there were APTMS (A) or not (B).

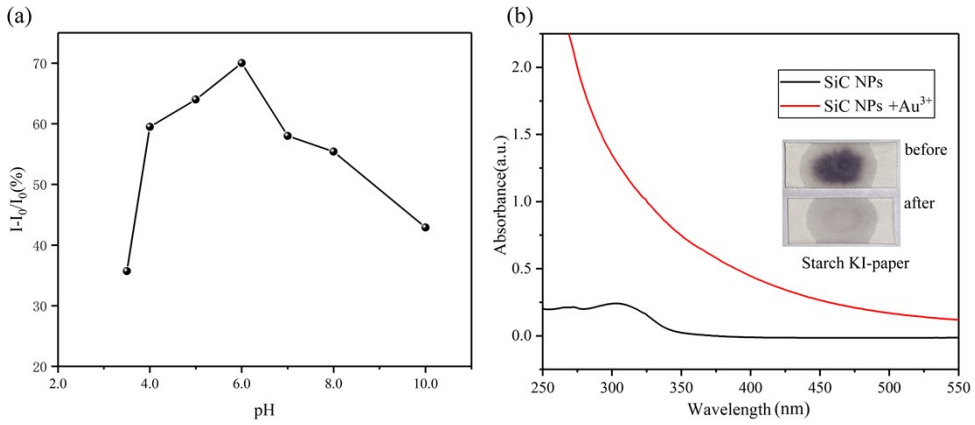


Figure S8. (a) Fluorescence quenching ratio of SiC NPs in different pH conditions. (b) UV-vis absorption spectrum of SiC NPs before and after the reaction with Au^{3+}, the inset showed the two results reacted with starch KI-paper.

Table S1. Quantum yield of SiC NPs

Sample	Y	A	η	
Quinine sulfate	1205.03	0.01	1.33	0.54
SiC NPs	135.474	0.01	1.33	0.061