



Supporting Information

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Rapid, High-Temperature, In Situ Microwave Synthesis of Bulk Nanocatalysts

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Geng Zhong^{1,a}, Shaomao Xu^{1,a}, Mingjin Cui¹, Qi Dong¹, Xizheng Wang¹, Qinqin Xia¹, Jinlong Gao¹, Yong Pei², Yun Qiao¹, Glenn Pastel¹, Takeshi Sunaoshi³, Bao Yang², Liangbing Hu^{1,*}

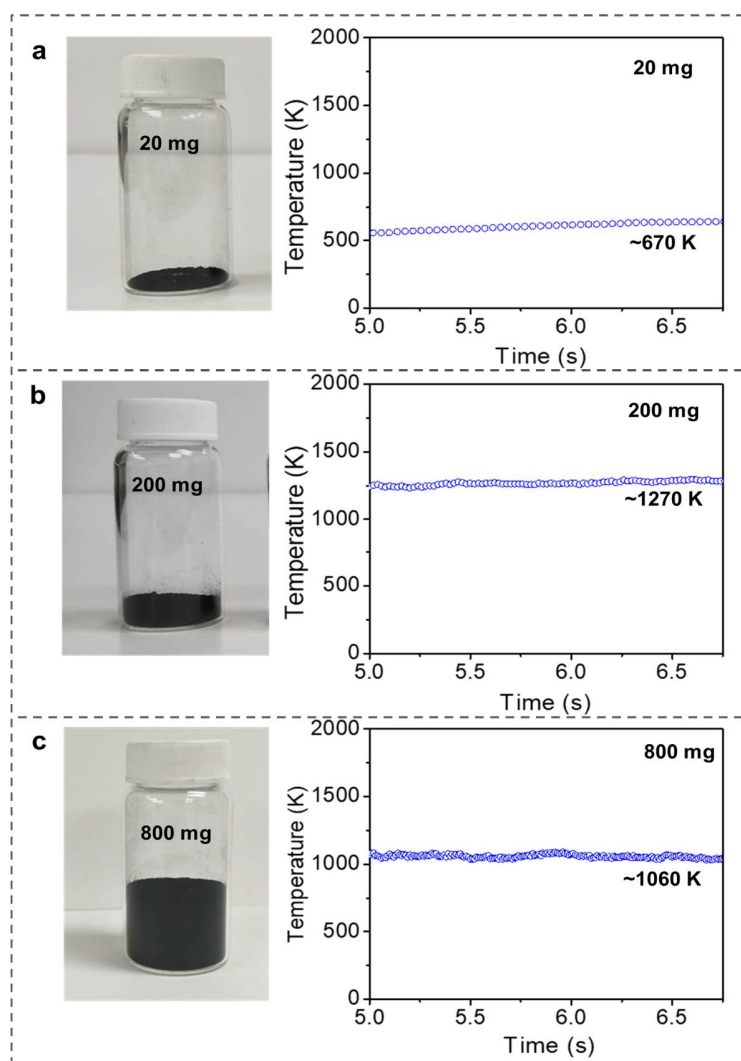


Figure S1. Photos (left) and corresponding temperature profiles during microwave heating (right) of carbon black with different masses. (a) 20 mg, (b) 200 mg and (c) 800 mg. The 20 mg of carbon black features relatively larger apparent surface area, which leads to excessive heat

dissipation, while 800 mg of carbon black will cause insufficient microwave coupling. Neither of them can achieve a high temperature (>1250 K) during microwave irradiation. A moderate amount of 200 mg sample leads to sufficient microwave coupling and controlled thermal dissipation, which is necessary to accumulate the coupled energy to realize a high temperature.

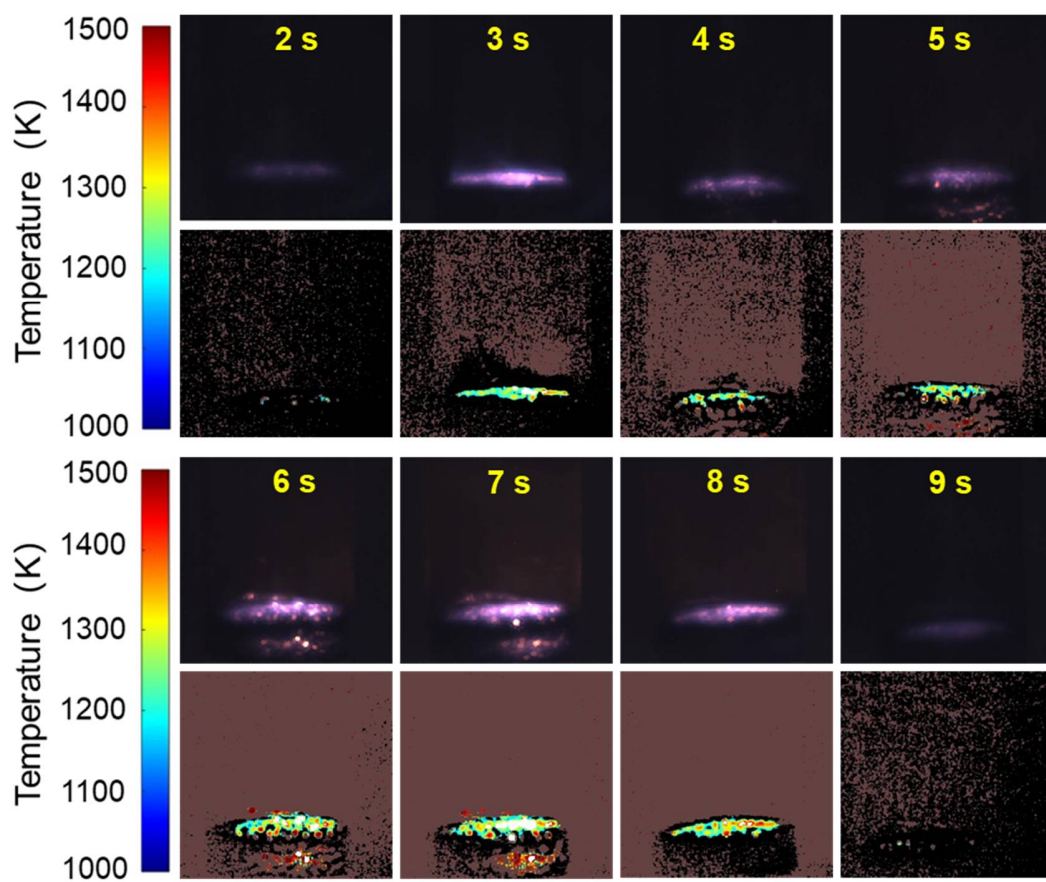


Figure S2. Digital photographs (top) and the corresponding calculated temperature profiles (bottom) at different times during the microwave irradiation process.

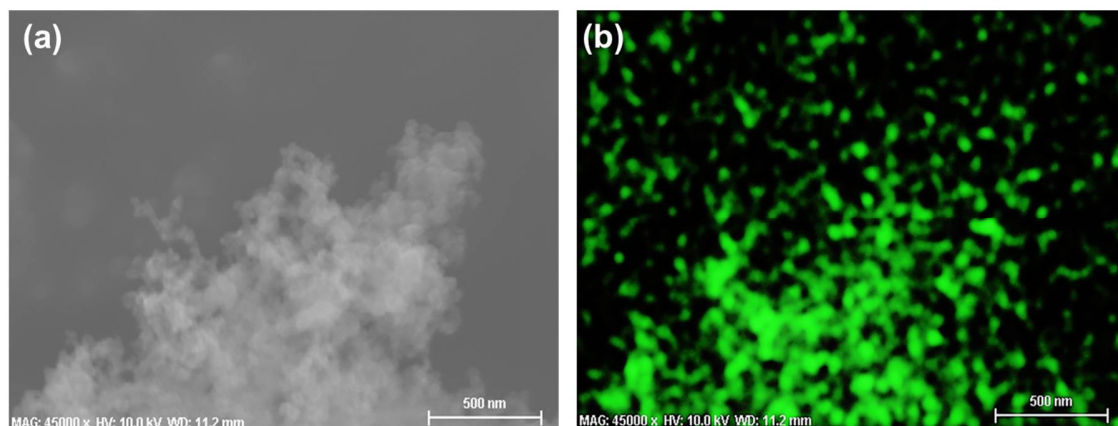


Figure S3. (a) SEM image of the CB/Ru. No nanoparticles other than the carbon black were observed. (b) However, elemental mapping shows the uniform distribution of Ru, demonstrating the ultra-small size of the Ru nanoparticles.

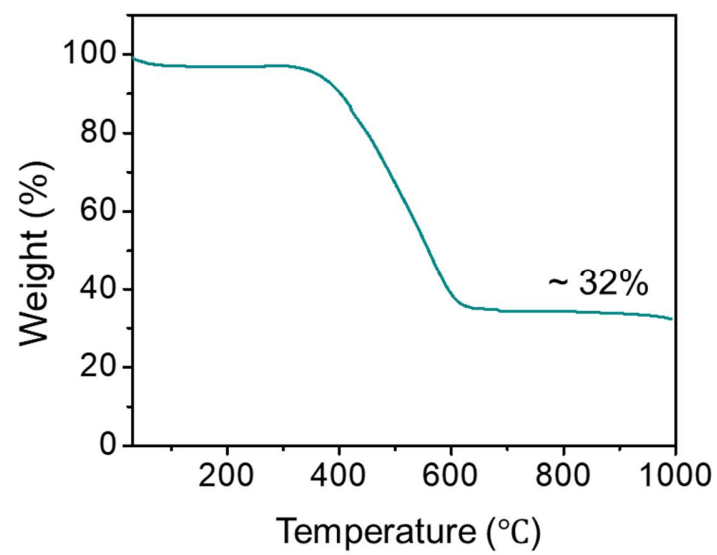


Figure S4. TGA profile of CB/Ru with a high Ru loading of ~32%.

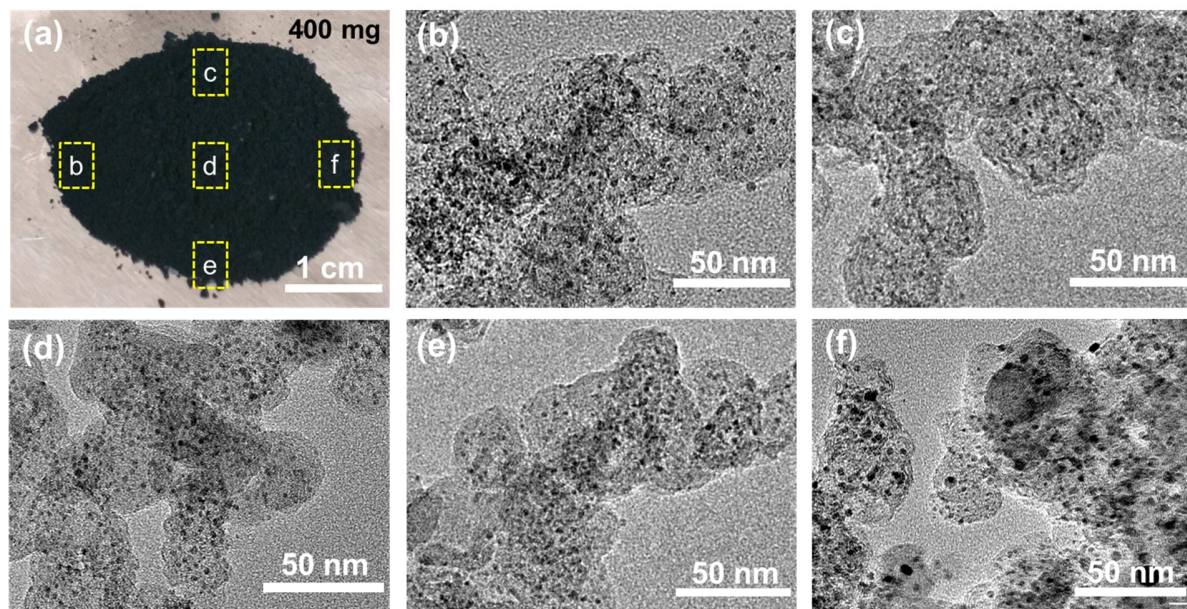


Figure S5. (a) Photo images of a large batch of the synthesized CB/Ru (400 mg). (b-f) TEM images of the sample at different positions demonstrating the similar morphology of the resulting nanoparticles embedded in the matrix of the carbon black substrate. These results indicate the good scalability and product uniformity of this microwave high-temperature synthesis method.

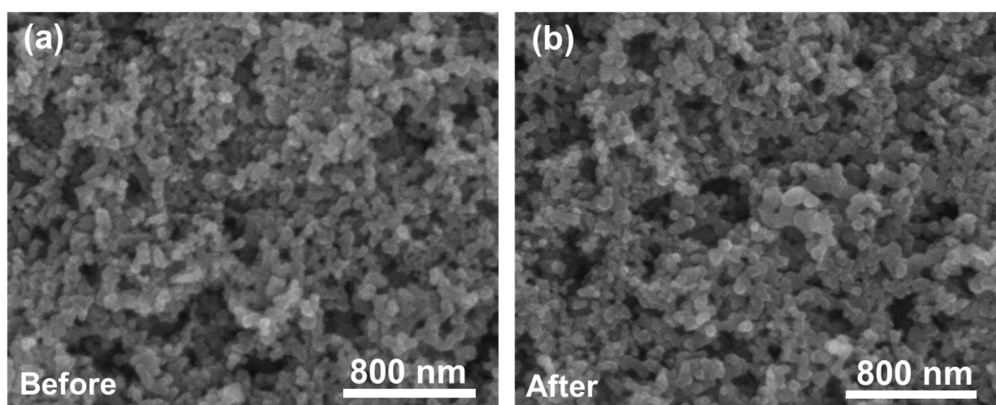


Figure S6. SEM images of carbon black before and after microwave heating. No difference in morphology was observed.

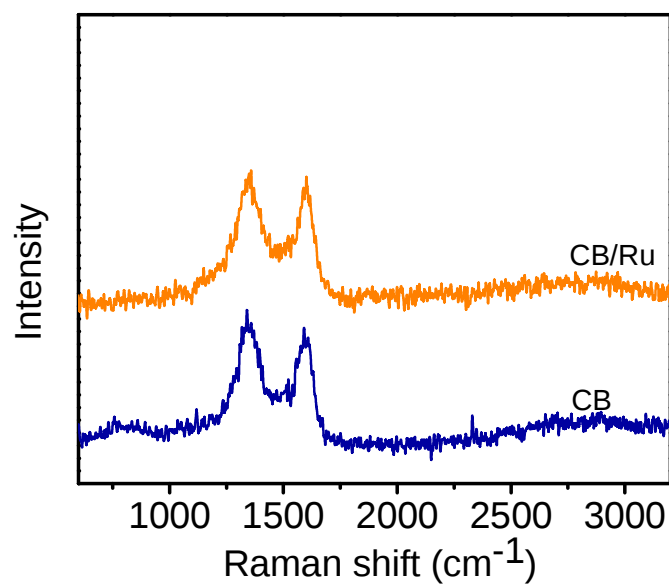


Figure S7. The indistinguishable Raman spectra of CB and CB/Ru, suggesting that negligible damage was introduced to the carbon black by microwave heating.

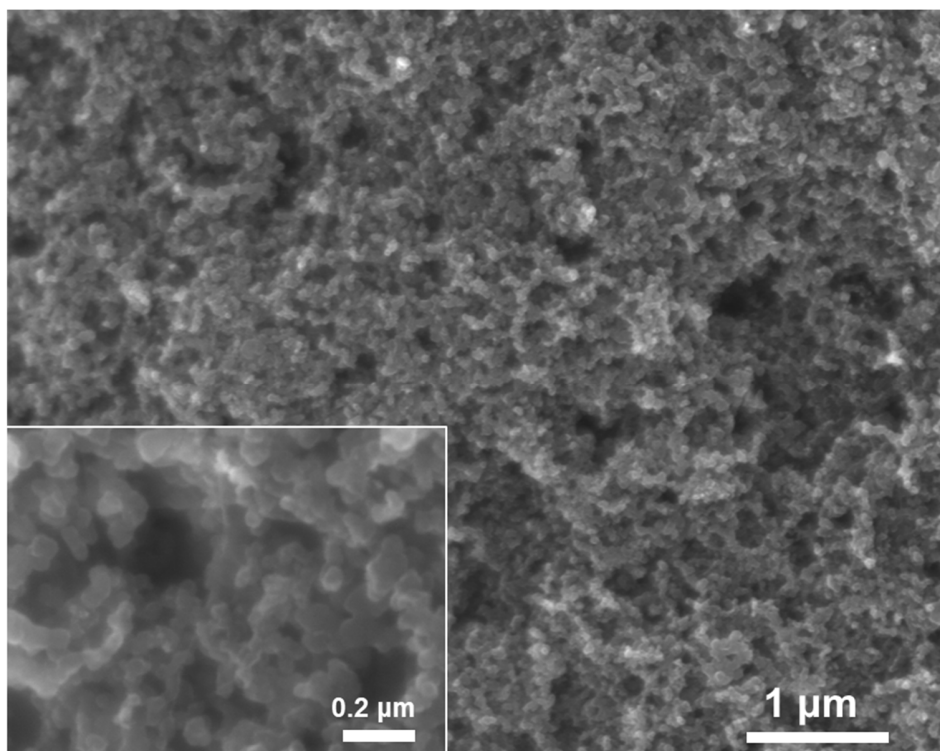


Figure S8. SEM images of pristine CB/Ru cathode. The inset is the magnified SEM image showing porous structure with no discharge product on the surface of the cathode.

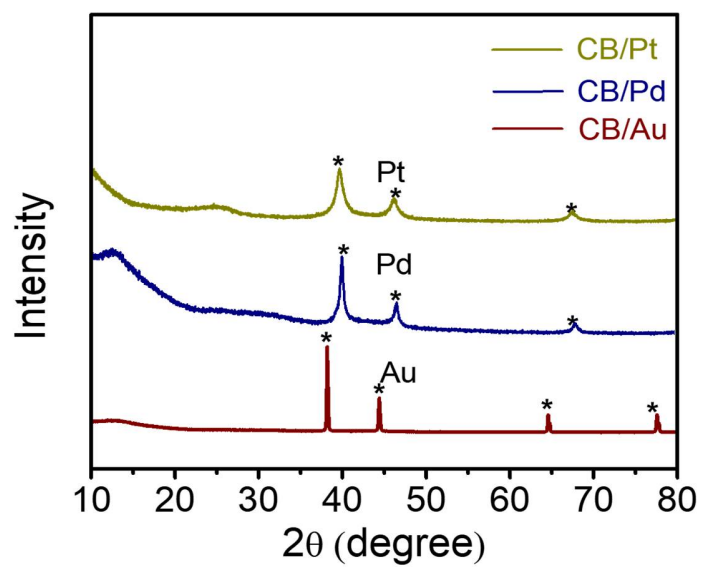


Figure S9. XRD patterns of CB/Pt, CB/Pd, and CB/Au. The peaks match well with the standard references of Pt, Pd and Au.