Supporting Information

Fundamental Studies of Ruthenium Species Supported on Boron Nitride Nanotubes: Metal Loading and Pretreatment Effects on CO Oxidation

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BET and PSD analysis

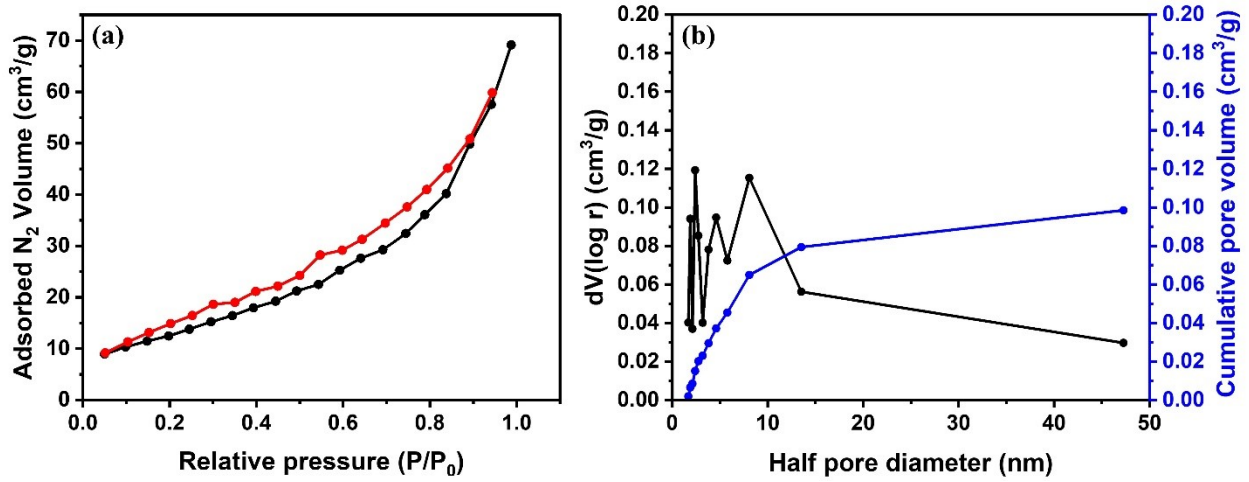

Fig. S1 N_2 adsorption-desorption analysis for bulk BNNT: (a) N_2 adsorption-desorption isotherm at 77K, and (b) pore size distribution (PSD) and cumulative pore volume.

The specific surface area (SSA) of the bulk BNNT powder was investigated using the BET method and was observed to be ~48.50 m^2/g. Fig. S1 (a) exhibits a Type-III hysteresis isotherm according to the IUPAC classifications, indicating the presence of meso-macropores in the bulk BNNT powder. Similar results have been reported in the CNT-based materials.[1–3] The macropores could be attributable to BNNT agglomerates. K. Kobashi et al. investigated the pore structures (e.g., micro-, meso-, and macropores) formed by CNTs with different diameters and wall numbers.[4] The authors reported that the measured pore sizes were larger than the diameter of CNTs, as individual CNTs and their bundles become CNT agglomerates, leading to the formation of meso- and macropores in the samples. Fig S1 (b) shows the pore size distribution (PSD) obtained from the BJH model. The data reveal that uneven pores between 4.0 – 8.0 nm were observed and were attributed to that of the BN-based entities (e.g. flakes, h-BN, incomplete growth of BNNT, etc). The presence of these entities was evident from a previous study.[5] The PSD data also show mesopores ranging from 10-30 nm, which correspond to the thorough pores of individual BNNT, as the inner diameter of each BNNT is 10-35 nm (Fig. 3 and 4). Based on the literature review and

obtained results, it is concluded that the various pore sizes in the sample are formed by at least three existing states: (i) BN-based entities; (ii) individual BNNT; and (iii) BNNT agglomerates. From the N_2 adsorption-desorption isotherm (Fig. S1 (a)), the adsorbed N_2 reached up to 70 cm^3/g, which is much higher than the cumulative pore volume as shown in Fig. S1 (b). This result indicates that the adsorbed N_2 volume is maximized on the external walls of BNNT, which is expected for a material exhibiting a type-III isotherm, as is the case with BNNT.

References

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