Supplementary Material (ESI) for Journal of Materials Chemistry

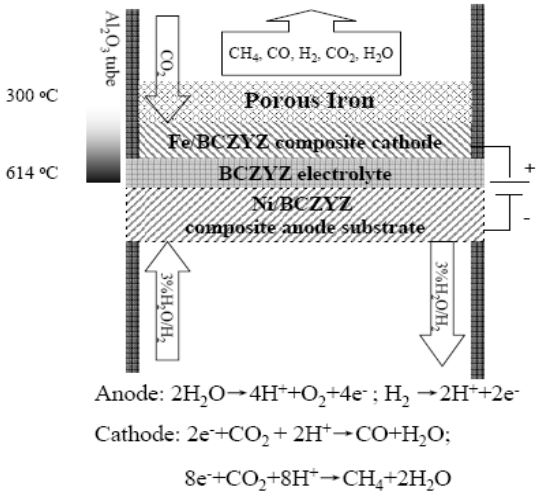
Electrochemical Reduction of CO_2 in a Proton Conducting Solid Oxide Electrolyzer-Supporting Information

Kui Xie,[a,b] Yaoqing Zhang,[a] Guangyao Meng,[b] and John T.S. Irvine*[a]

[a] *School of Chemistry, University of St Andrews, St Andrews, Fife KY16 9ST, UK. Fax: 44 1334 463808; Tel: 44 1334 463844; E-mail: jtsi@st-andrews.ac.uk*

[b] *Department of Materials Science and Engineering, University of Science and Technology of China, Hefei, Anhui 230026, China.*

Fig.S1* Schematic of testing conditions



Anode: $2H_2O \rightarrow 4H^+ + O_2 + 4e^-$; $H_2 \rightarrow 2H^+ + 2e^-$

Cathode: $2e^- + CO_2 + 2H^+ \rightarrow CO + H_2O$;

$8e^- + CO_2 + 8H^+ \rightarrow CH_4 + 2H_2O$

Fig.S2* Cross-sectional (left) and surface (right) view of half cell with BCZYZ electrolyte on NiO-BCZYZ substrate

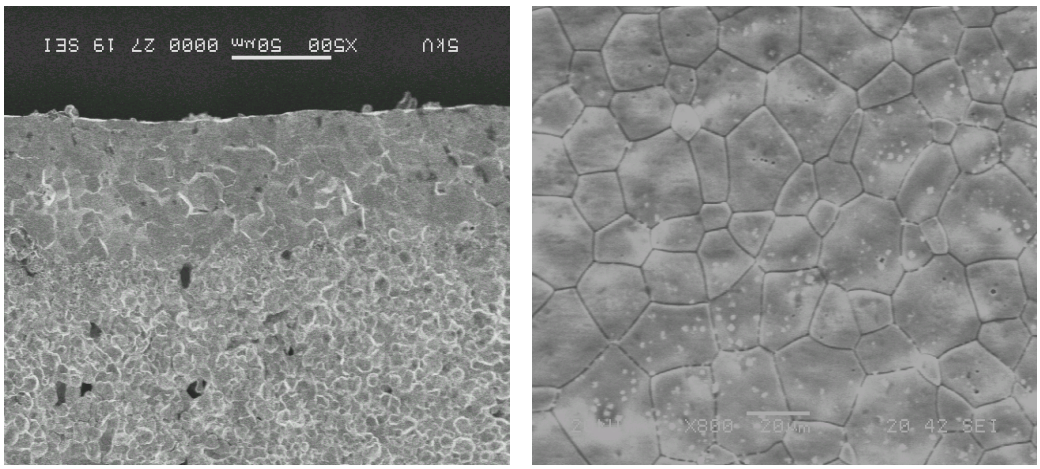


Fig.S3* Bode plot of solid oxide electrolyzer under different external loadings

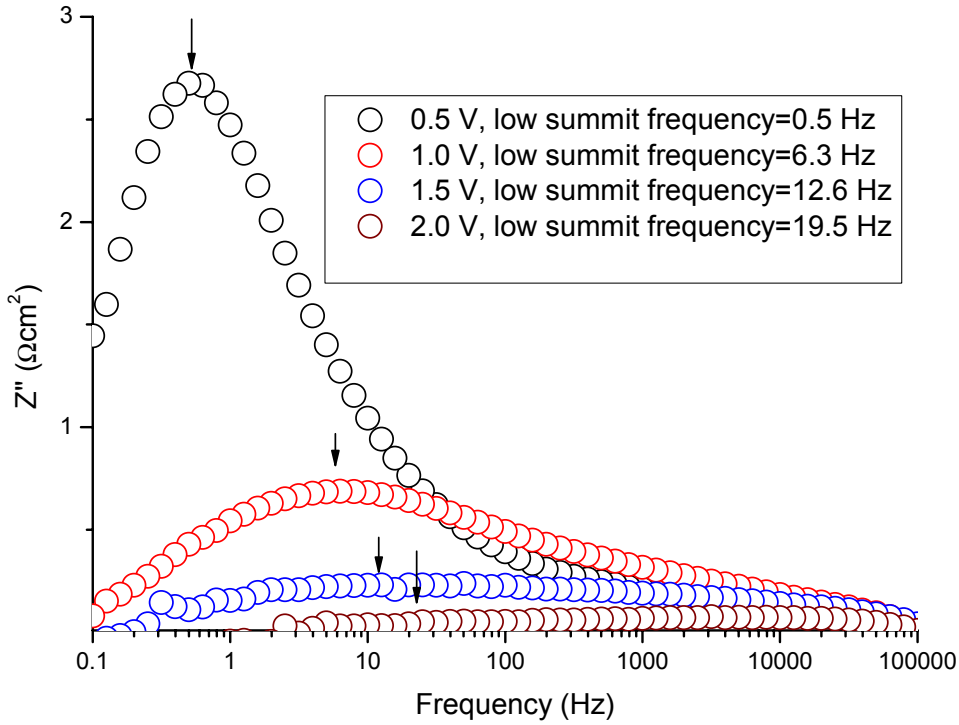


Fig.S4* Mass spectroscopy of output gas in electrochemical reduction process

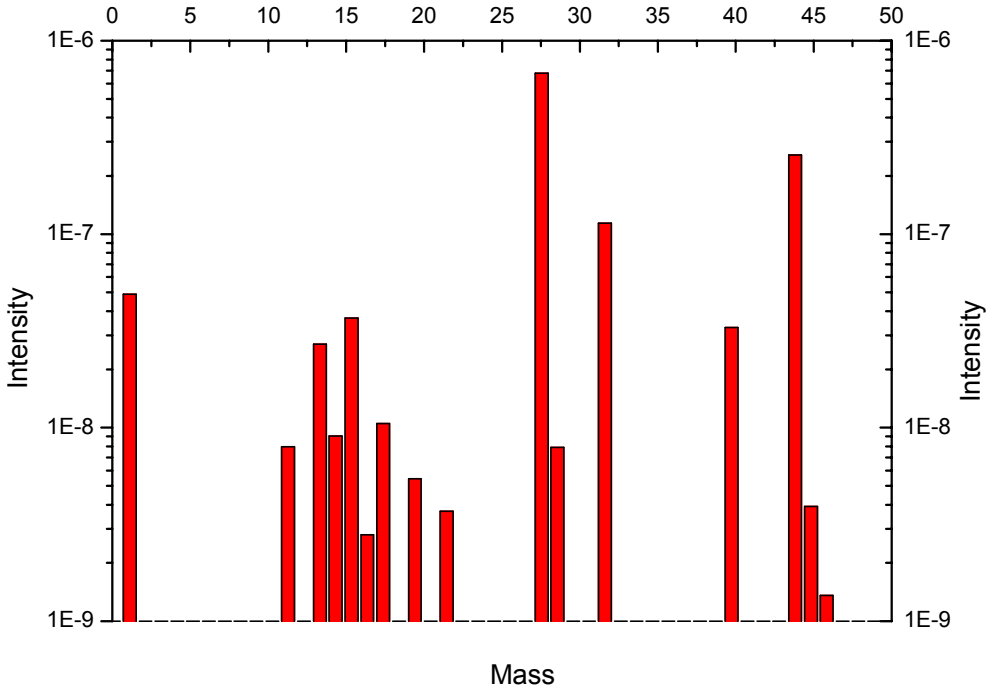


Fig.S5* Mass spectroscopy of output gas in reverse water gas shift reaction process

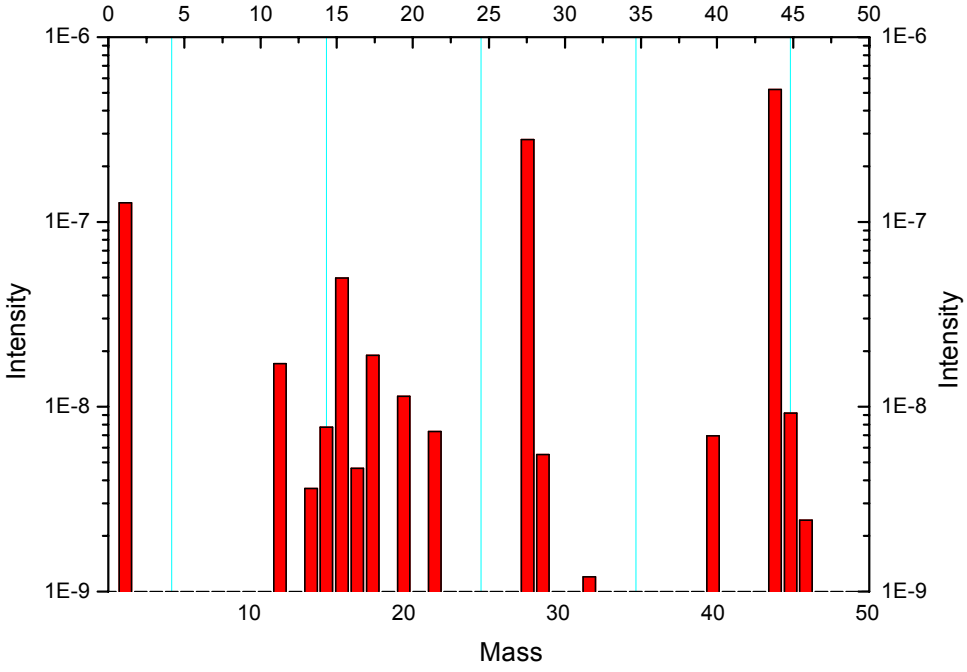


Fig.S6* Mass spectroscopy of 10% methane in argon

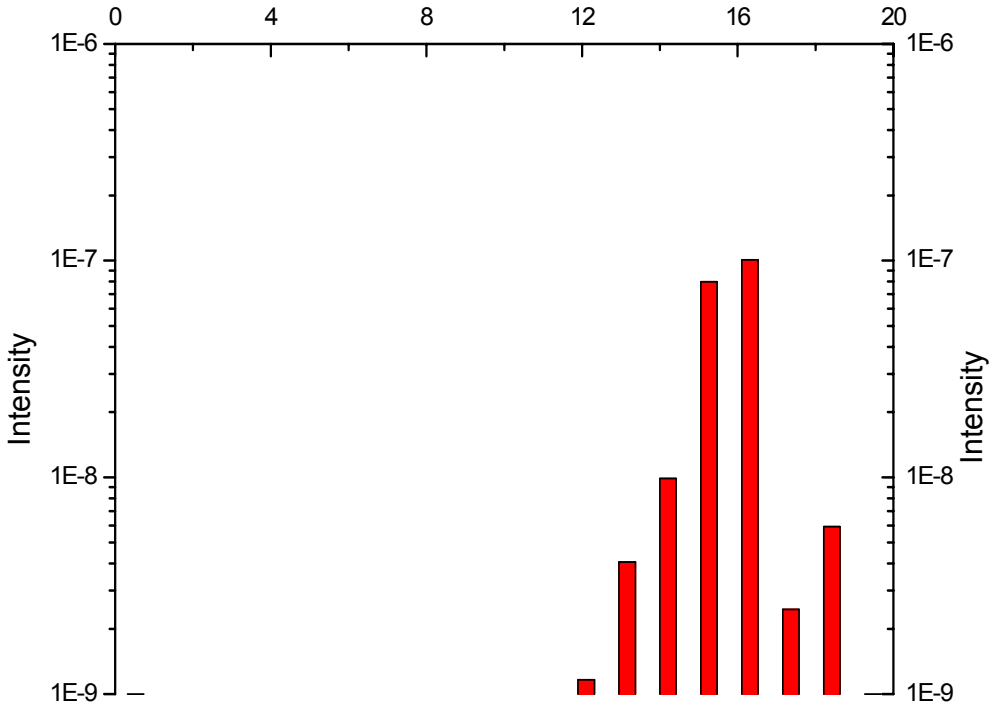


Fig.S7* Mass spectroscopy of 100% CO_2

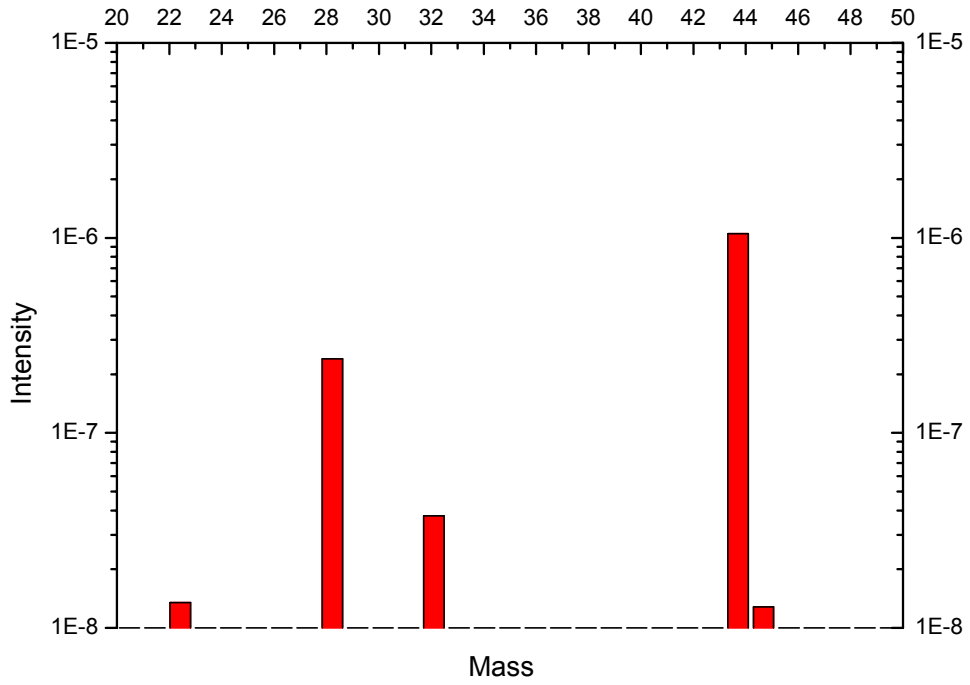


Fig.S8* Mass spectroscopy of 100% CO

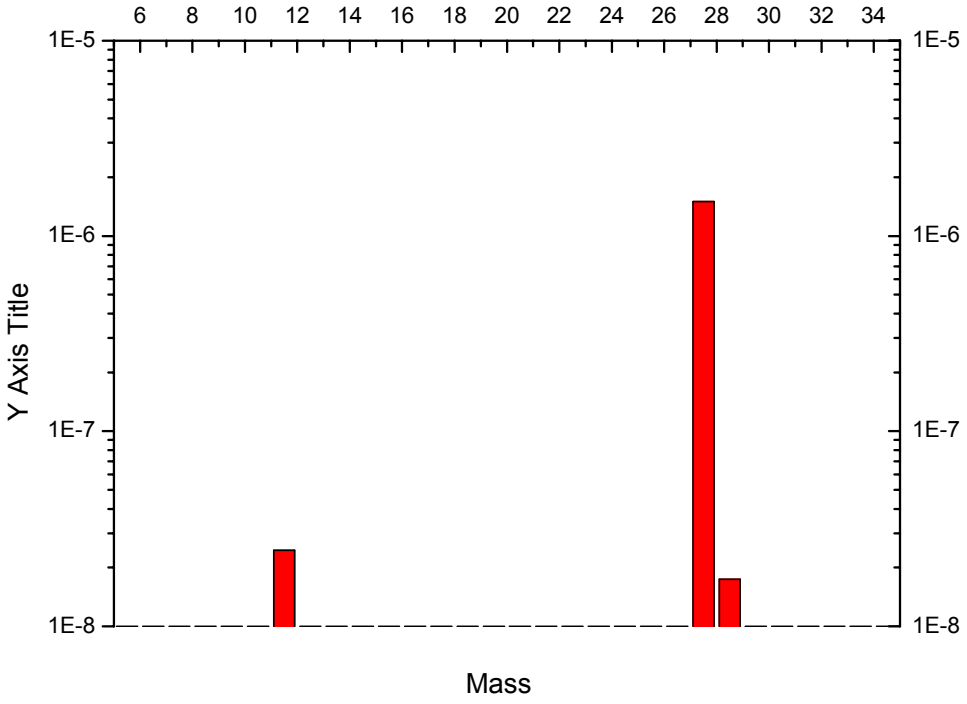


Fig.S9* Mass spectroscopy of 5% hydrogen in argon