Title: A one-pot chitosan pyrolysis in the presence of a $ZnCl_2$/NaCl salts for carbons with electrocatalytic activity.

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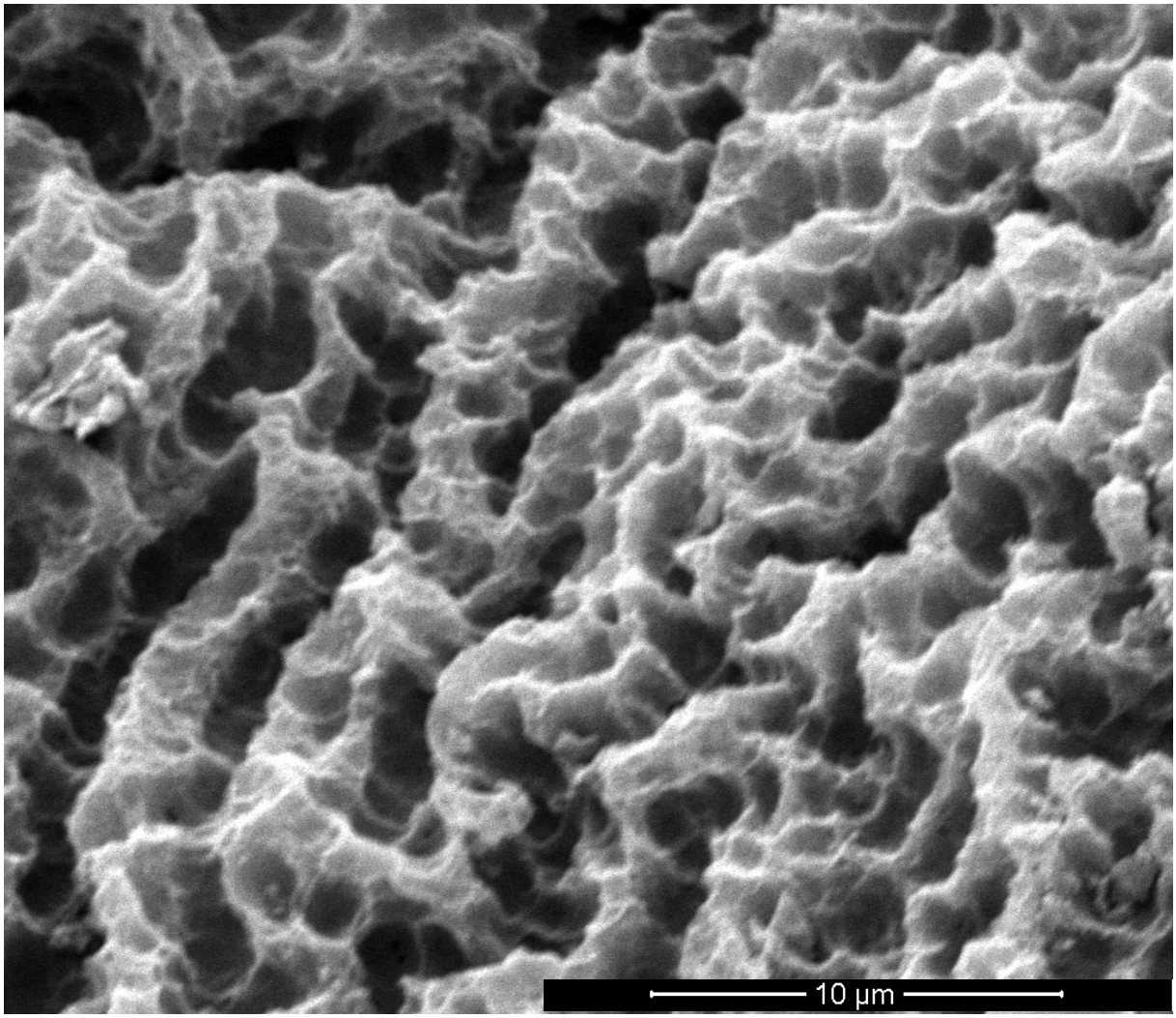
Supplementary information

1. The samples were characterized by scanning electron microscopy FEI Quanta 3D ESEM/FIB.


10 µm

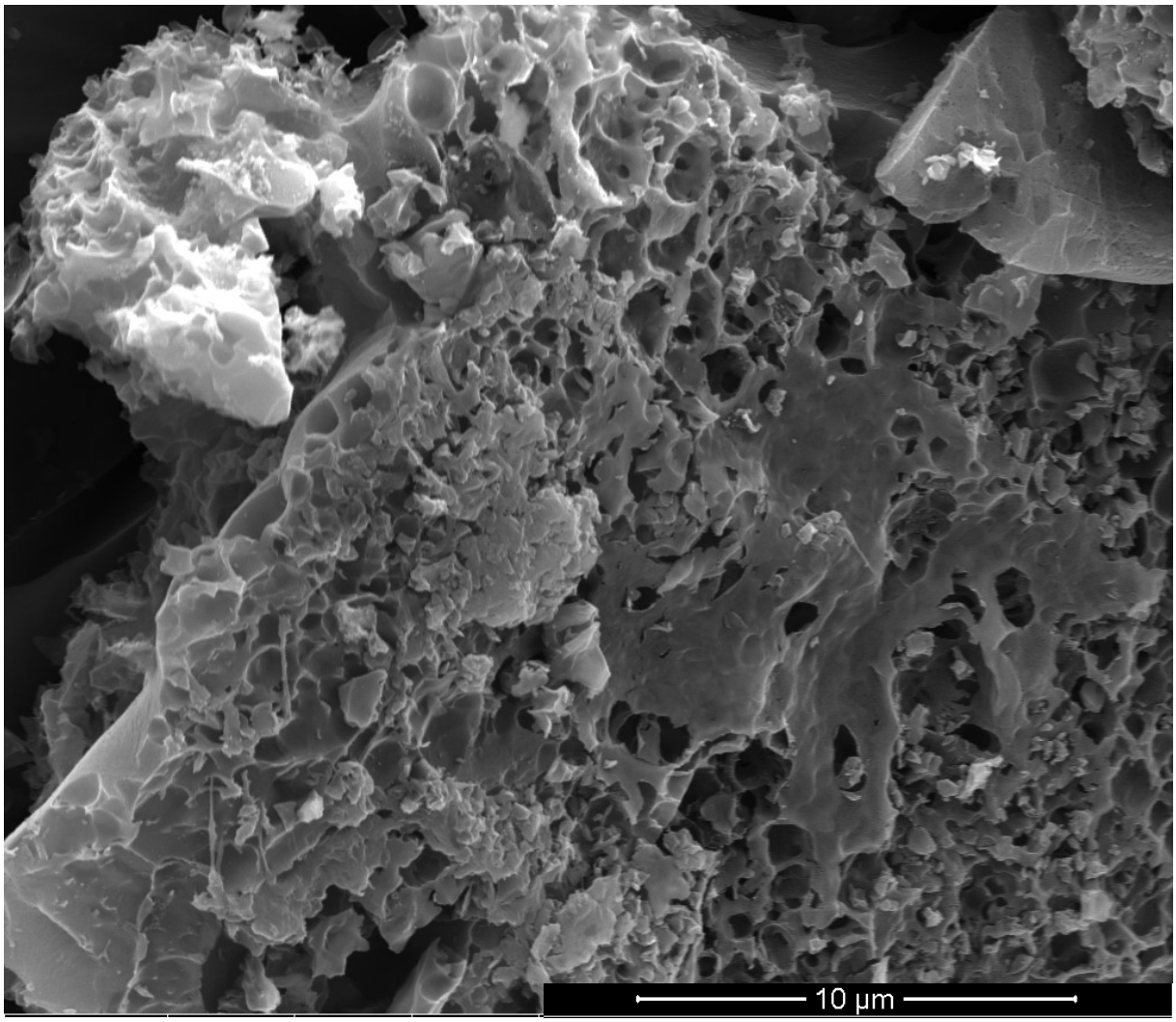


Fig. S1. SEM images of the CH_Na samples

2. All potentials were converted into reversible hydrogen electrode (RHE) scale by adding 0.965 V. The 'real' current from ORR, the LSV measurements were performed in both N_2 and O_2, and then removed the current of N_2 from that of O_2 in order to get rid of the significant the double-layer capacitance seen in carbons.

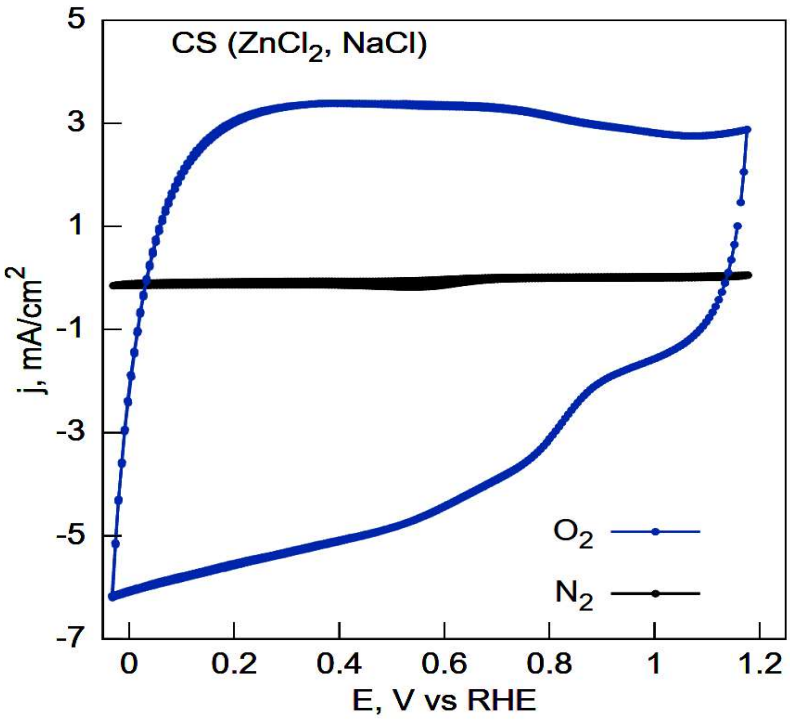


Fig. S2. Cyclic voltammograms of the CH_Na samples in saturated 0.1M KOH solution

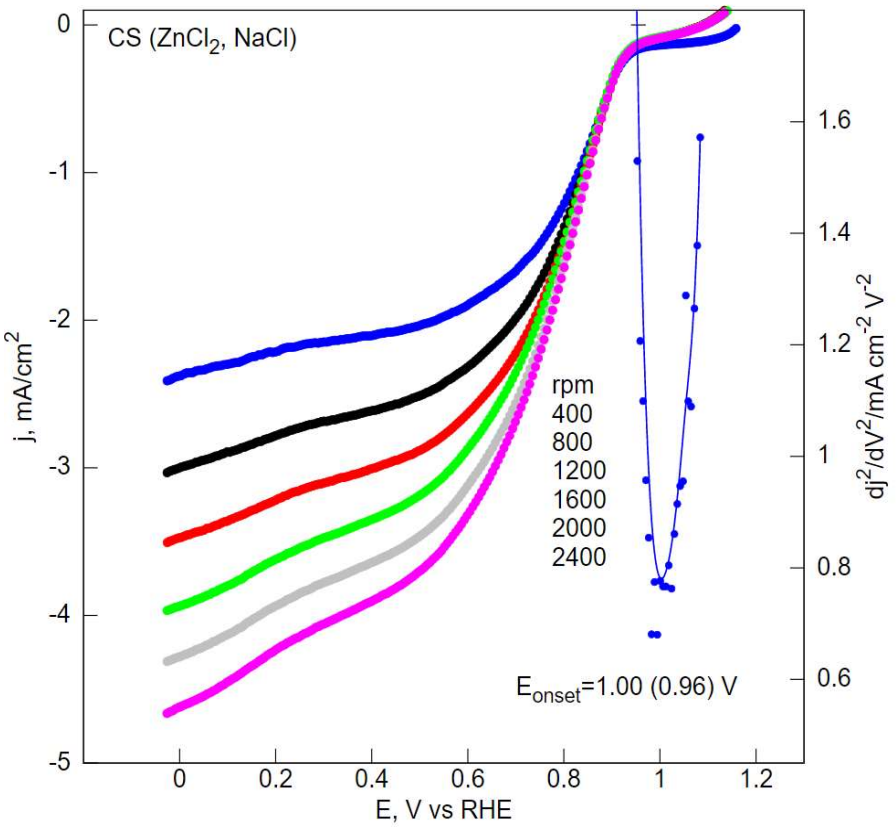


Fig. S3. Linear sweep voltammetry curves of CH_Na catalyst for the ORR obtained in oxygen saturated 0.1 M KOH aqueous solution. Scan rate: 10 mV/s. Electrode rotation rates as indicated.

The number of electrons was calculated from the current with the angular velocity of the disk ω using Koutecky–Levich (K-L) plots of CH catalyst for the ORR obtained in O_2 saturated 0.1 M KOH at selected potentials (from 400 rpm to 2400 rpm). From all the date we got the current density and corresponding rpm value. From the plot J^{-1} vs $\omega^{-1/2}$, we got the K-L plots. Finally, from the slope of the line we got the number of electron transfer in ORR. It was determined by the K–L equation:

$$\frac{1}{j} = \frac{1}{j_k} + \frac{1}{j_l} = \frac{1}{nFAkC} + \frac{1}{0.62nFAD^{\frac{2}{3}}\omega^{\frac{1}{2}}v^{-\frac{1}{6}}C}$$

where *j* represents the measured current density, *jk* and *jl* are the kinetic and the diffusion-limited current densities, respectively. The electron transfer in the oxygen reaction is described by *n*, *F* is the Faraday constant (96485 C/mol), *A* is the electrode area, *k* is the rate constant for the oxygen reduction, *D* is the diffusion coefficient of oxygen in the electrolyte (1.9×10^{-5} cm^2/s), *ω* is the angular velocity of the electrode, *v* is the kinematic velocity of the electrolyte (0.01 cm^2/s) and *C* is the concentration of saturated oxygen in the electrolyte (1.2×10^{-3} mol/L). The number of electrons *n* transferred during the oxygen reduction can then be calculated by the slope, when plotting $1/j$ vs. $1/\omega^{1/2}$.

TOF was calculated based on the formula:

$$\text{TOF [Turn Over Frequency]} = \frac{\text{current [A/cm}^2\text{] [C/s]}}{\text{1.6x10^-19 x S.D. x } \tau} \quad \text{[1/s]}$$

S.D. - volumetric site density [sites/cm^3]

τ - thickness of the layer [cm]

Table S1. Pores surface and volume of carbonaceous samples obtained by CS pyrolysis.

Sample	Total area $m^2\ g^{-1}$	Micropore area $m^2\ g^{-1}$	Mesopore area $m^2\ g^{-1}$	Total pore volume $cm^3\ g^{-1}$	Micro-pore volume $cm^3\ g^{-1}$	Meso-pore volume $cm^3\ g^{-1}$	Pore With	Ref
CH_Na	1217.4	947.9	248.560	0.770	0.539	0.231	1.051	This work
CH_Li	1317.9	708.9	609.700	1.230	0.380	0.850	2.600	[23]

CH	7.8	n/a	n/a	0.02	n/a	n/a	3.939	[23]