Electronic Supplementary Information (ESI)

Thermodynamically Favorable Route to the Synthesis of Nanoporous Graphene Templated on CaO *via* Chemical Vapor Deposition

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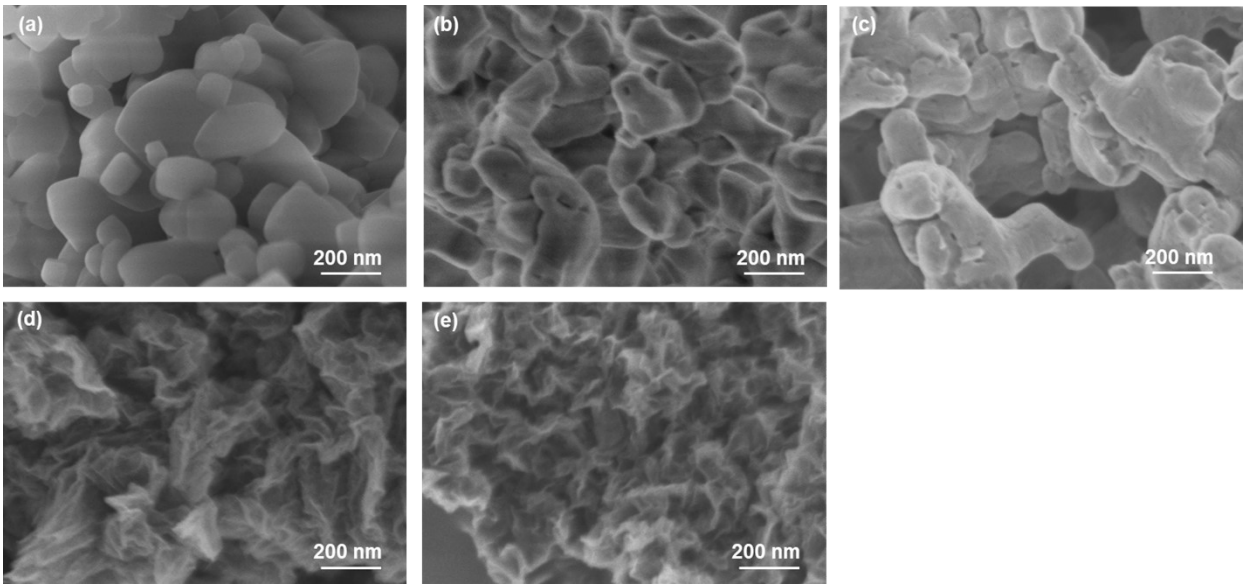

Fig.S1 SEM images of (a) SK-I, (b) SK-I_900, (c) C/SK-I, (d) TC_SK-I, and (e) TC_SK-I_A

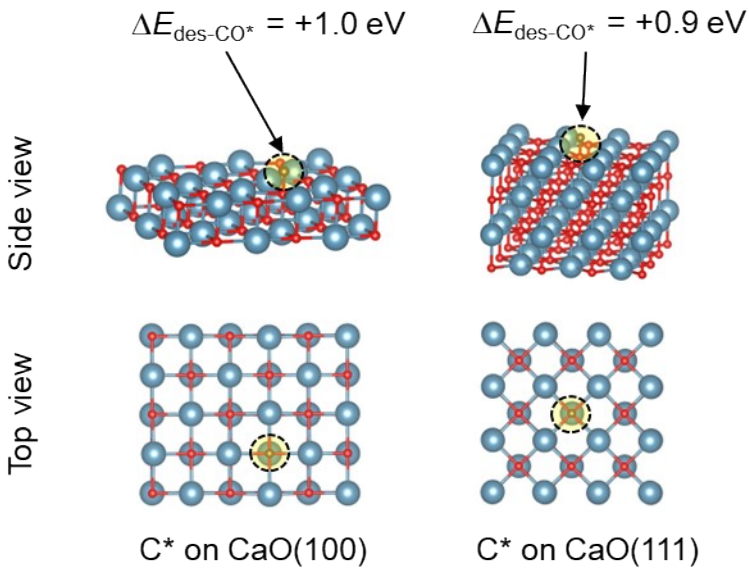

Fig. S2 Side and top views of the optimized structural models of (left) C*on CaO(100), , and (right) C* on CaO(111) with the values of the CO desorption energy ($\Delta E_{des\text{-}CO*}$) from the labeled C* on O sites. The blue, red, and brown balls represent Ca, O, C atoms, respectively.

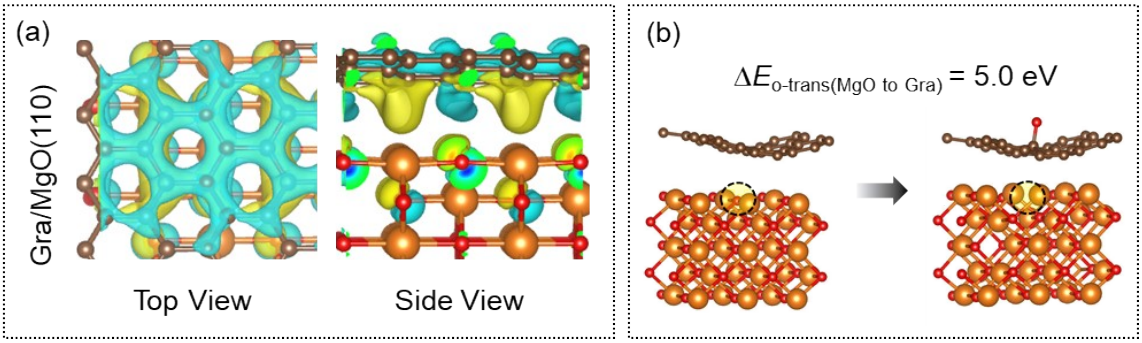

Fig. S3 (a) Charge density mappings of graphene/MgO(110) (Gra/MgO(110)). (b) The optimized structural model of Gra/MgO(110) and O* on Gra/MgO(110) with the energy required for transferring O from MgO to the surface graphene ($\Delta E_{\text{O-trans(MgO to Gra)}}$). The red, orange, and brown balls represent O, Mg, and C atoms, respectively.

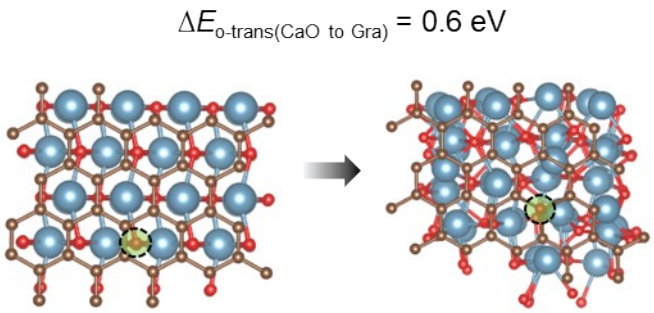

Fig. S4 Top views of the optimized structural models of Gra/CaO(110) and O* on Gra/CaO(110) with the energy required for transferring O from CaO to the surface graphene ($\Delta E_{\text{O-trans(CaO to Gra)}}$). The green region locates the transferred O.

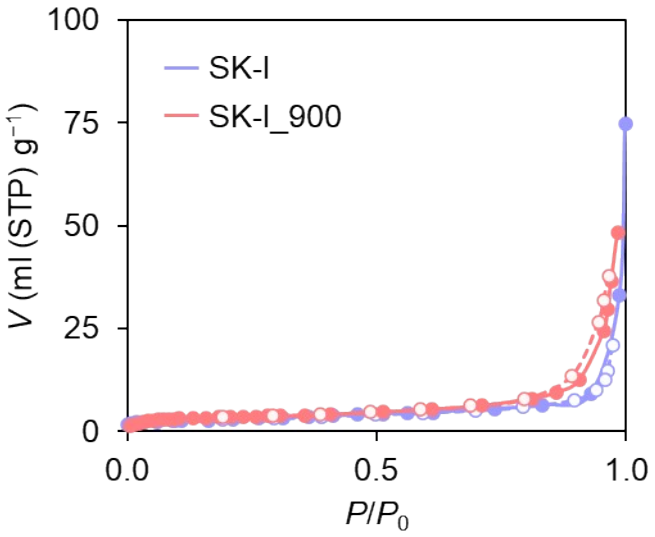

Fig. S5 N_2 adsorption/desorption isotherms at −196 °C for SK-I and SK-I_900.

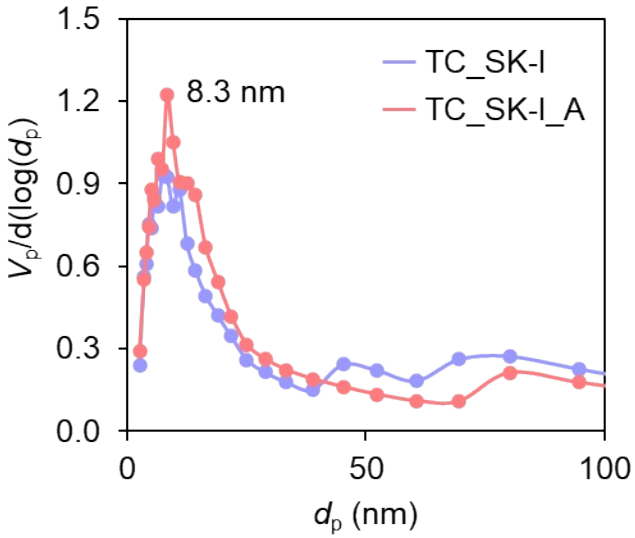

Fig. S6 Pore-size distributions calculated by the BJH method for TC_SK-I and TC_SK-I_A.

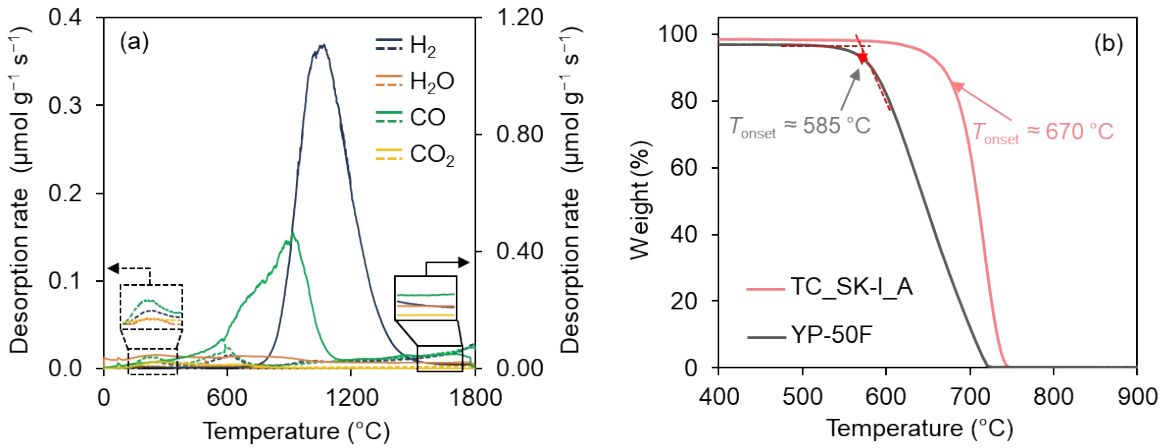

Fig. S7 (a) Gas evolution patterns of YP-50F (solid lines) and TC_SK-I_A (dashed lines) during the high-sensitivity TPD measurement up to 1800 °C. (b) The oxidation resistance of YP-50F and TC_SK-I_A characterized by TG measurement in air. The heating rate is 5 °C min^{-1}.

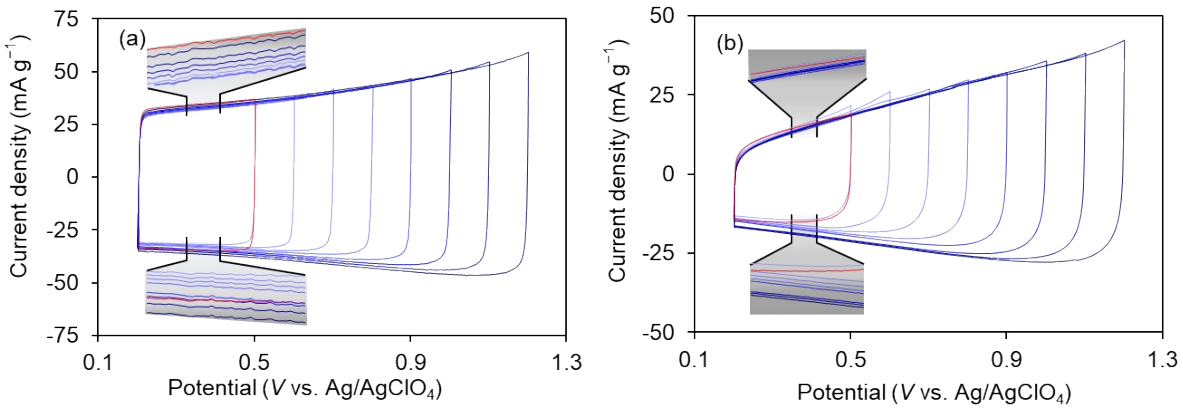

Fig. S8 Cyclic voltammograms measured with a scan rate of 1 mV s^{-1} using (a) TC_SK-I and (b) TC_SK-I_A. A three-electrode cell was used with 1 M Et_4NBF_4/propylene carbonate at 25 °C. The blue lines represent the data during the upper limit potential inclining step in the range of 0.5-1.2 V. The red line is the data measured between 0.2 and 0.5 V following the CV performed from 0.2 to 1.2 V.

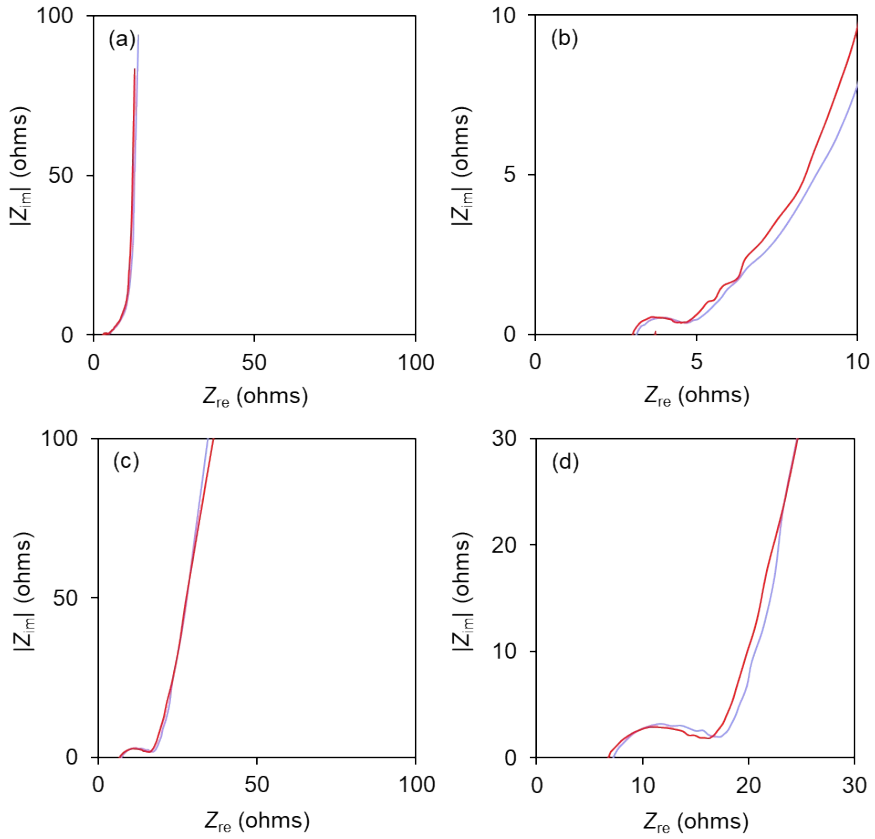

Fig. S9 The Nyquist plots of TC_SK-I and TC_SK-I_A measured by using a three-electrode cell in 1 M Et_4NBF_4/propylene carbonate at 25 °C. Nyquist plots at OCV (0.2 V) obtained throughout cyclic votemetry (CV) measurement of (a,b) TC_SK-I (c,d) TC_SK-I_A. The blue line represents the data before the CV measurement. The red line is data measured following the CV performed form 0.2 to 1.2 V.

Table S1 Impurities contained in $CaCO_3$ analyzed by inductively coupled plasma atomic emission spectroscopy (ICP-AES). The data are kindly provided by Shiraishi Central Laboratories Co., Ltd.

Sample	Impurity content (ppm)					
	Na	Mg	Fe	Sr	Si	Al
SK-I	27.8	4.2	3.5	3.5	6.9	<0.1