Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supplementary Information

Ultrafine SiO_x/C Nanospheres and Their Pomegranate-Like Assemblies for High-Performance Lithium Storage

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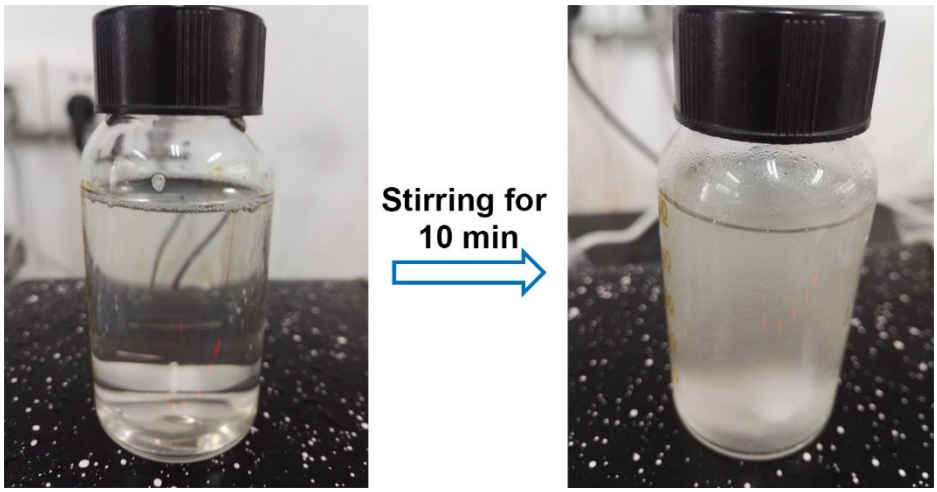

Fig. S1 Digital photo of the ultrafine SiO_2 colloid solution obtained by the hydrolysis and condensation of TPOS in aqueous 3-aminophenol/CTAB/HMTA solution for 10 min.

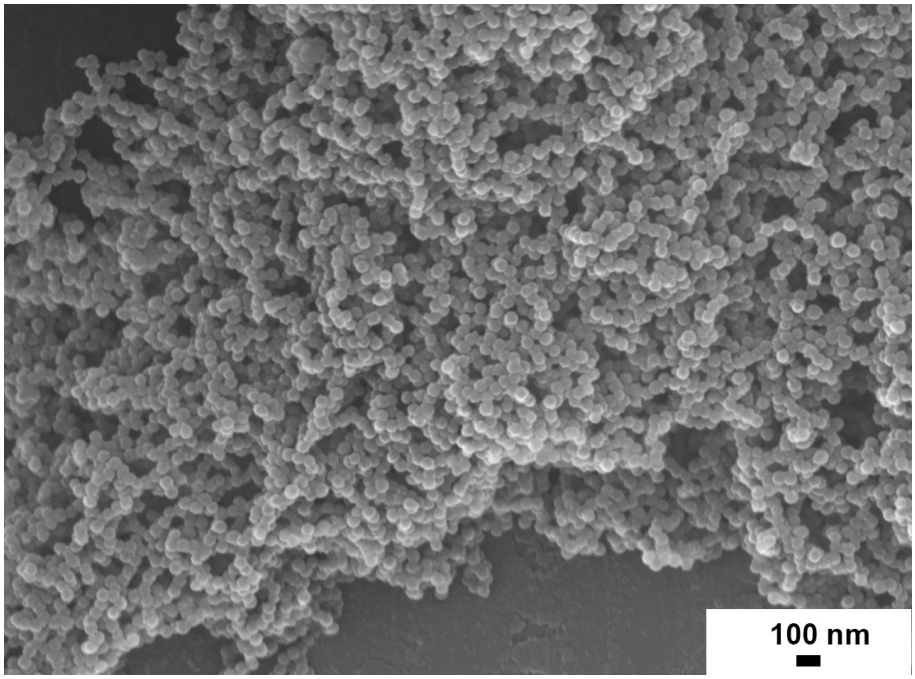

Fig. S2 SEM image of SiO_2/resin-2.

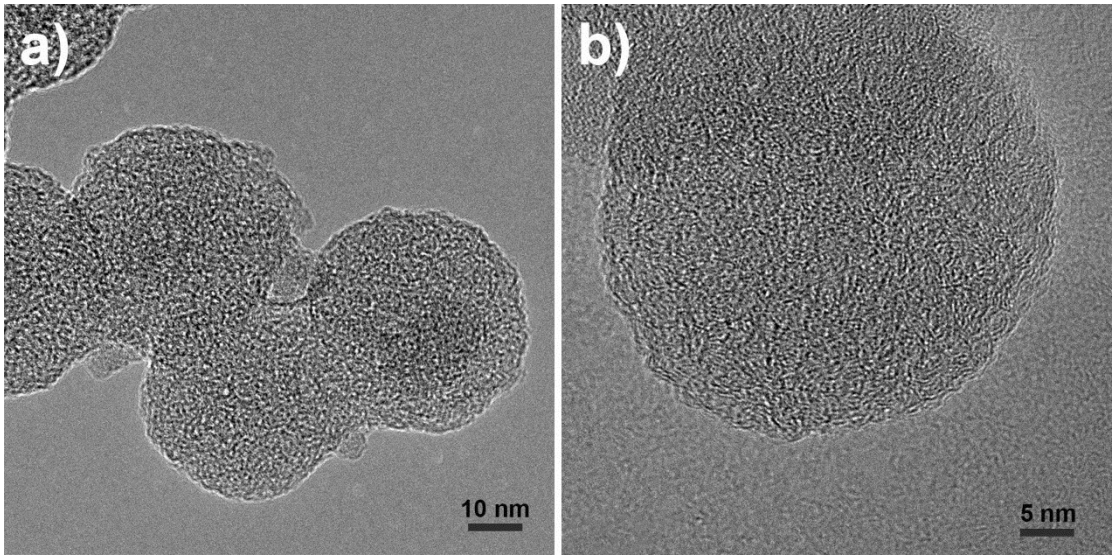

Fig. S3 HREM images of SiO_x/C-2 (a – b).

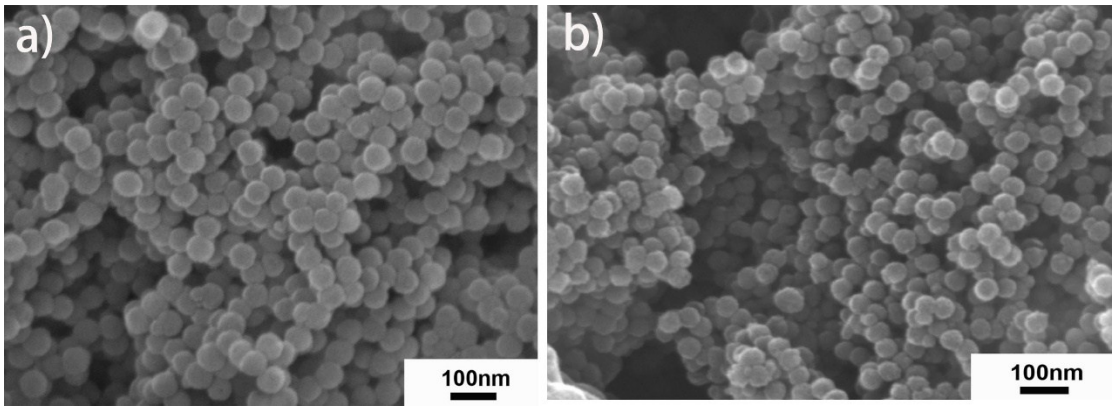

Fig. S4 SEM images of SiO_2/resin-1(a) and SiO_x/C-1 (b).

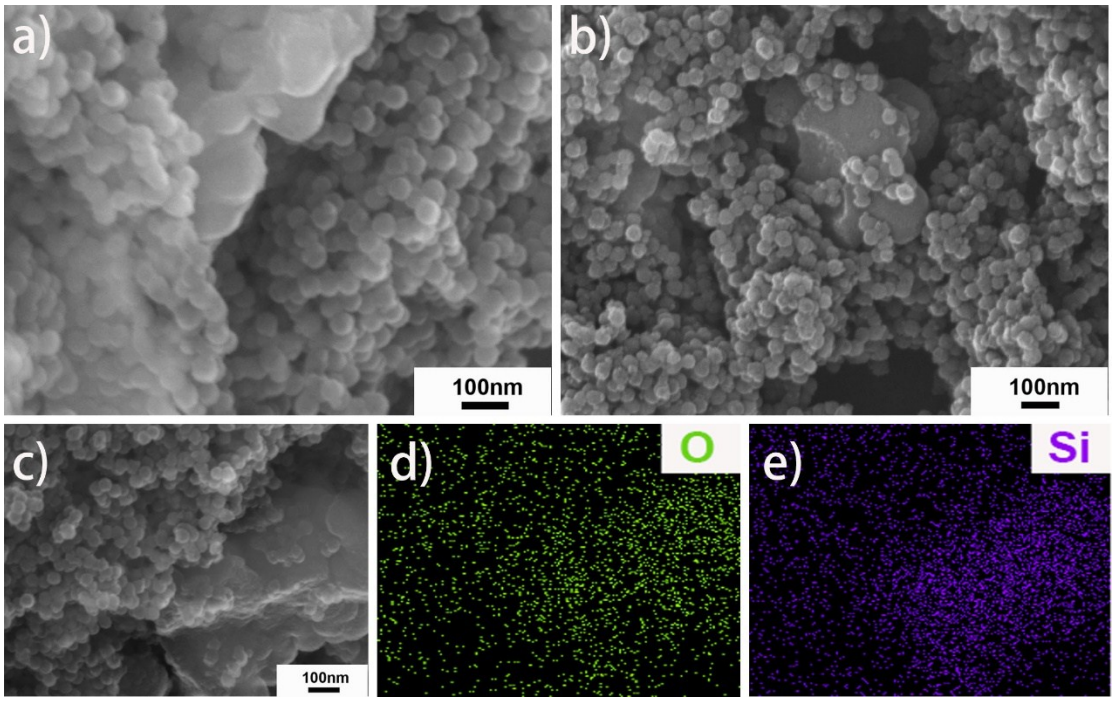

Fig. S5 SEM images of SiO_2/resin-3 (a) and SiO_x/C-3 (b), EDS elemental mappings of SiO_x/C-3 (c – e).

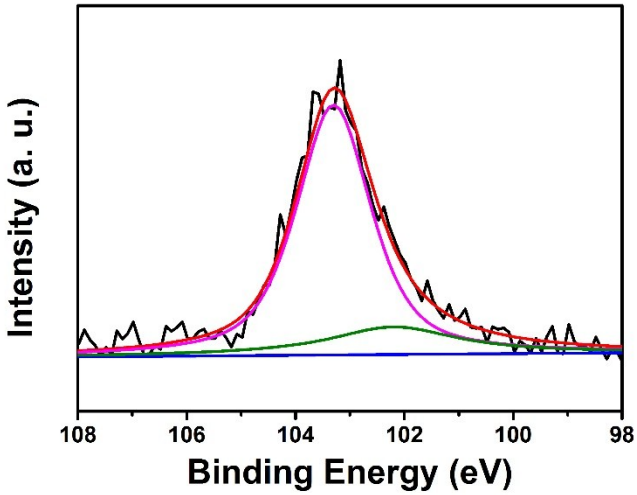

Fig. S6 High resolution Si 2p spectrum of SiO_x/C-2. The sample is subjected to Ar^+ etching before XPS measurement. The etching depth is ~20 nm.

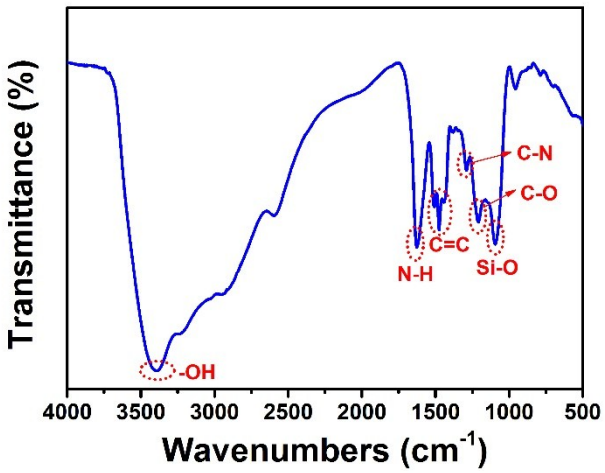

Fig. S7. FT-IR spectrum of SiO_2/resin nanospheres.

The functional groups on SiO_2/resin nanospheres are analyzed by FT-IR spectrum (Fig. S7), which clearly shows the stretching/deformation vibrations of -OH (~3388 cm^{-1}), N-H (~1622 cm^{-1}), C=C (~1476 and 1506 cm^{-1}), C-N (~1293 cm^{-1}), Si-O (~1095 cm^{-1}), and C-O (~1208 cm^{-1}).

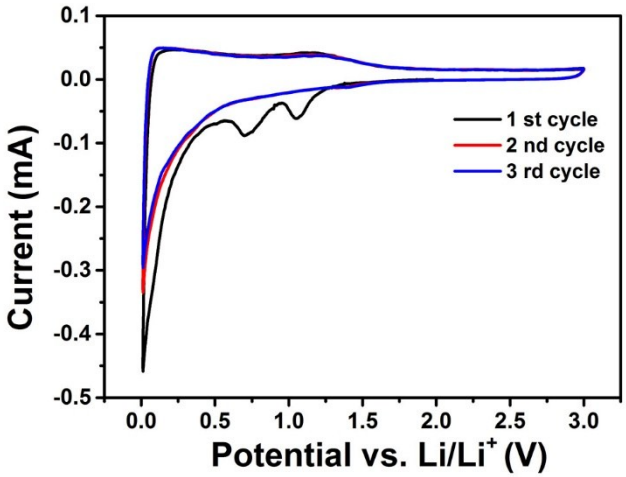

Fig. S8 Cyclic voltammetry profiles of SiO_x/C-2 measured in the potential range of 0.01 – 3.0 V with a scan rate of 0.1 mV s^{-1}.

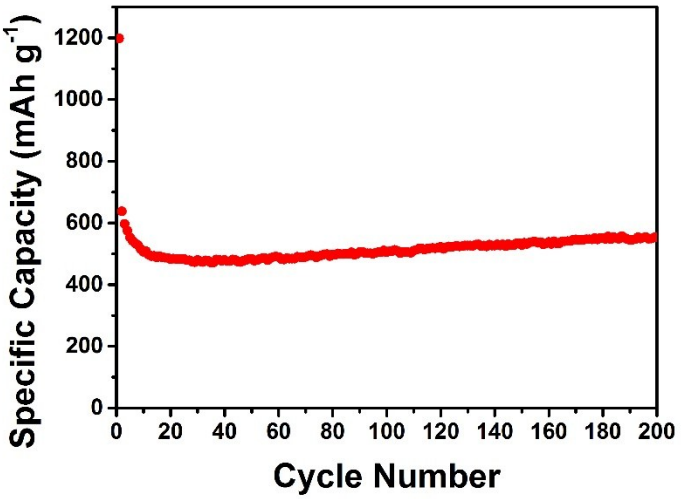

Fig. S9 Cycling performance of hollow carbon nanospheres at 500 mA g^{-1}. The hollow carbon spheres are prepared by etching SiO_x/C-2 nanospheres with HF.

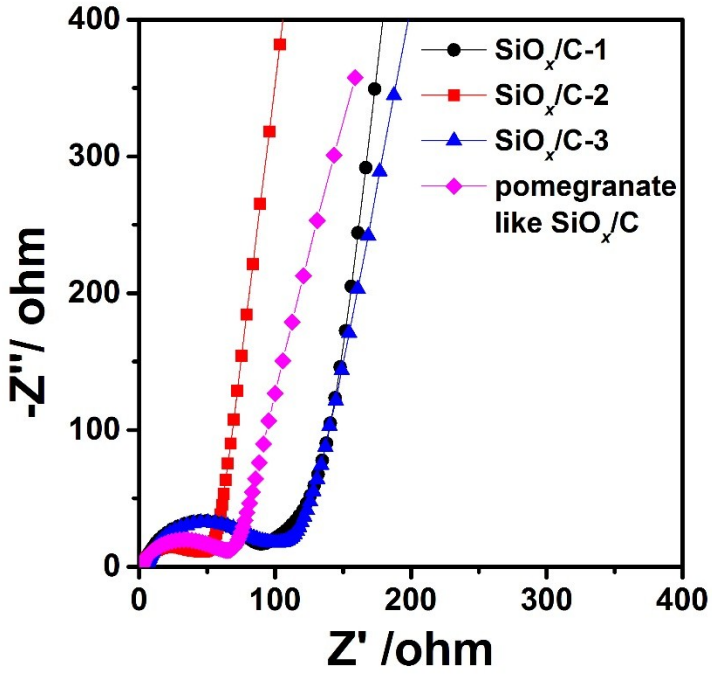

Fig. S10 Nyquist plots of the SiO_x/C samples at 25 °C.

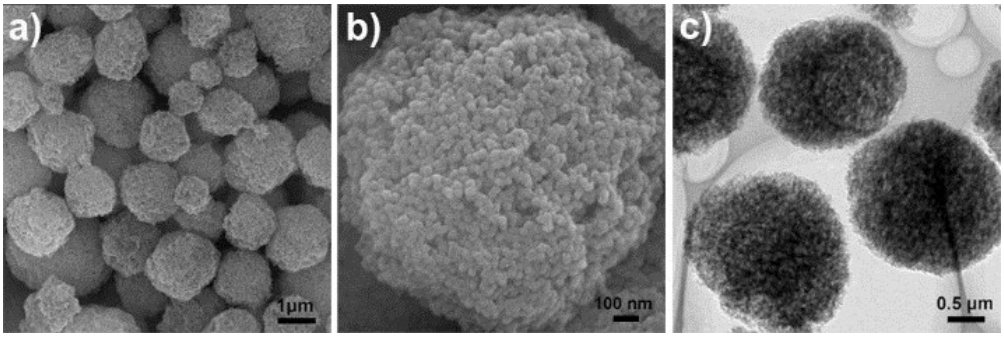

Fig. S11 SEM (a, b) and TEM (c) images of pomegranate-like SiO_2/resin-2.

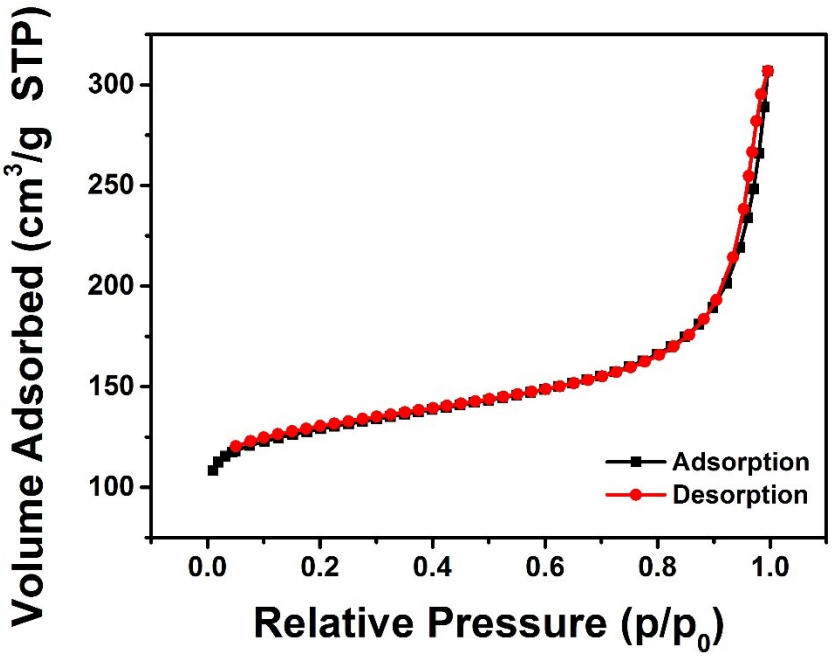

Fig. S12 N_2 adsorption/desorption isotherm of the pomegranate-like SiO_x/C-2.

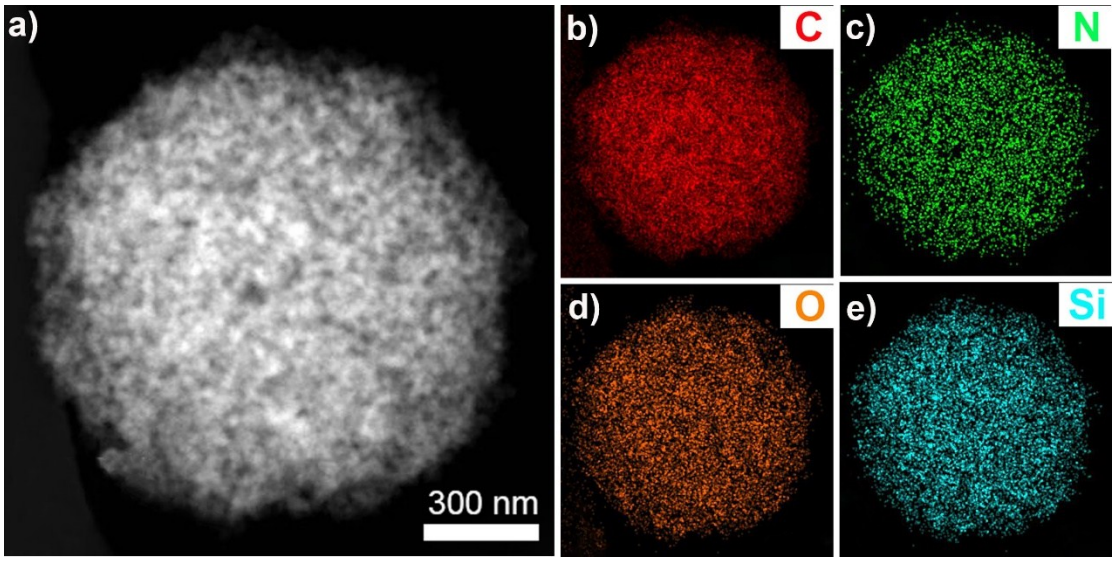

Fig. S13 EDS elemental mappings of C, N, O and Si (a-e) of pomegranate-like SiO_x/C-2 microspheres.

Table S1. Synthesis parameters of SiO_x/C nanospheres.

Sample	3-aminophenol (g)	HMTA (g)	H_2O (mL)	CTAB (g)	TPOS (mL)
SiO_x/C-1	0.2	0.255	20	0.15	0.9
SiO_x/C-2	0.2	0.255	20	0.15	1.2
SiO_x/C-3	0.2	0.255	20	0.15	1.5

Table S2. The specific surface area, total pore volume, and pore size of the SiO_x/C nanocomposites.

Sample	BET surface area ($m^2\ g^{-1}$)	Pore Volume ($cm^3\ g^{-1}$)
SiO_x/C-1	232.8	0.21
SiO_x/C-2	475.7	0.37
SiO_x/C-3	361.3	0.30
pomegranate-like SiO_x/C-2	404.3	0.47

Table S3. Comparison of the lithium storage performances of SiO_x/C-2 with literature values.

Sample	Reversible capacity	Cycle number	Ref
SiO_x/C-2	829 mAh g^{-1} at 1.0 A $^{-1}$	1000	This work
pomegranate-like SiO_x/C-2	808 mAh g^{-1} at 0.5 A g^{-1}	200	
SiO_x/SiO_y	750 mAh g^{-1} at 0.5 A g^{-1}	150	1
SiO_x/C	675 mAh g^{-1} at 0.1 A g^{-1}	100	2
SiO_2/C hollow sphere	910 mAh g^{-1} at 0.2 A g^{-1}	150	3
SiO_2	700 mAh g^{-1} at 0.2 A g^{-1}	250	4
$SiO_{0.37}$/graphene	1300 mAh g^{-1} at 0.3 A g^{-1}	50	5
C@Si-SiO_2	920 mAh g^{-1} at 0.1 A g^{-1}	500	6
SiO_2/C	620 mAh g^{-1} at 0.1 A g^{-1}	300	7
SiO_2/N-doped C	820 mAh g^{-1} at 0.2 A g^{-1}	20	8
SiO_x/C@RGO	1284 mAh g^{-1} at 0.1 A g^{-1}	100	9
SiO_x/C nanowire	623 mAh g^{-1} at 0.5 A g^{-1}	150	10
SiO_2@C	441 mAh g^{-1} at 0.5 A g^{-1}	500	11
Si/SiO_2/C nanofiber	405 mAh g^{-1} at 0.5 A g^{-1}	1000	12
SiO_2 multi-shelled hollow sphere	750 mAh g^{-1} at 0.1 A g^{-1}	550	13
porous SiO_2/C	611 mAh g^{-1} at 0.2 A g^{-1}	200	14

References

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