Electronic Supplementary Material (ESI) for RSC Advances.

High dielectric constant and capacitance in ultrasmall (2.5 nm) $SrHfO_3$ perovskite nanoparticles produced from a low temperature non-aqueous sol-gel route

Mohamed Karmaoui,*[a,b] E. Venkata Ramana,[c] David M. Tobaldi,[a] Luc Lajaunie,[d] Manuel. P. Graça,[c] Raul Arenal,[d,e] Maria P. Seabra,[a] João A. Labrincha[a] and Robert C. Pullar*[a]

[a] *Department of Materials and Ceramic Engineering / CICECO – Aveiro Institute of Materials, University of Aveiro, Campus universitário de Santiago, 3810-193 Aveiro, Portugal*

[b] *School of Chemistry-College of Engineering and Physical Sciences- University of Birmingham, Edgbaston, Birmingham B15 2TT, UK*

[c] *I3N-Aveiro, Department of Physics, University of Aveiro, Campus universitário de Santiago, 3810-193 Aveiro, Portugal*

[d] *Laboratorio de Microscopías Avanzadas, Instituto de Nanociencia de Aragón, Universidad de Zaragoza, 50018 Zaragoza, Spain*

[e] *ARAID Foundation, 50018 Zaragoza, Spain*

*E-mail: rpullar@ua.pt; karmaoui@ua.pt and m.karmaoui@bham.ac.uk

Electronic Supporting Information (ESI):

Figure S1. ^{13}C NMR spectrum of the filtered reaction solution measured in $CDCl_3$ for the $SrHfO_3$ metal oxide nanoparticles.

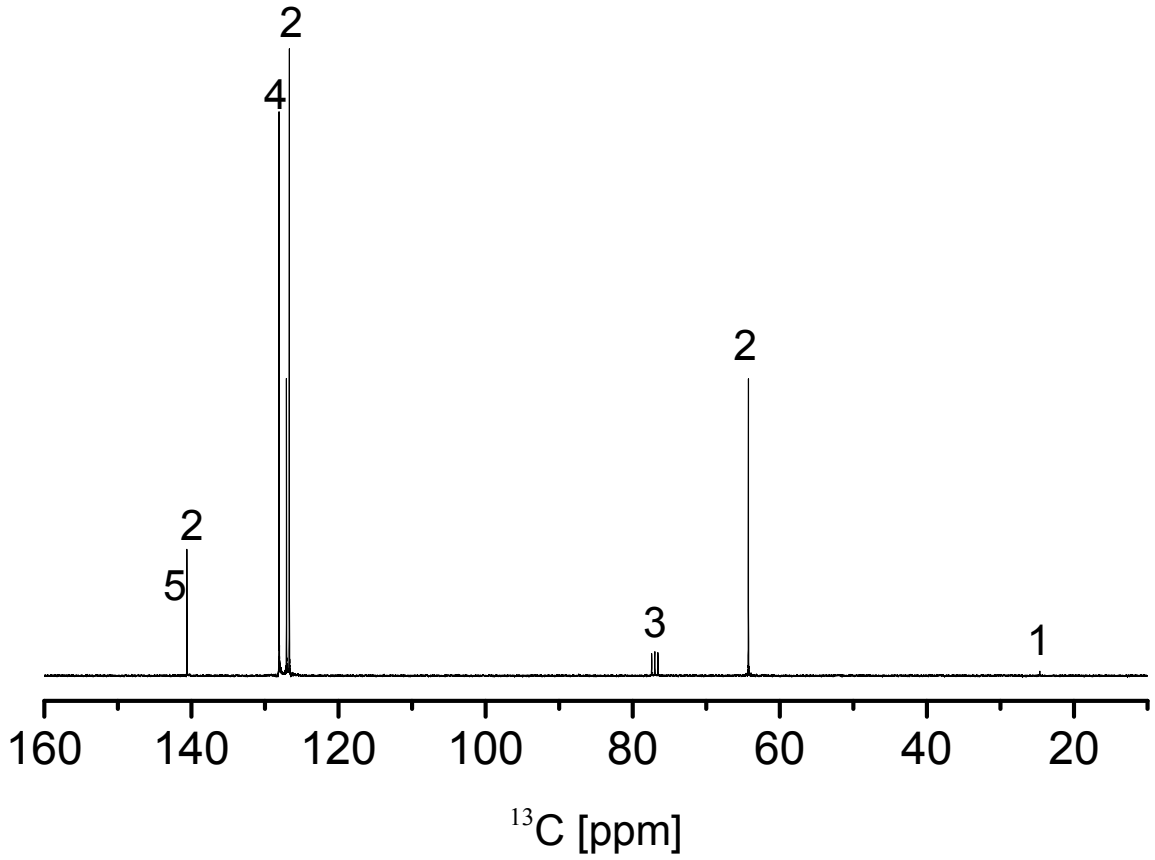
Figure S2. ^{1}H NMR spectrum of the filtered reaction solution measured in $CDCl_3$ for the $SrHfO_3$ metal oxide nanoparticles.

Figure S3. Gas chromatogram of the final reaction solution after filtration measured in hexane.

Table 1. Retention times and structures of relevant organic species

Table 2. WPPM agreement factors, unit cell parameters, average crystalline domain diameter, and mode of the size distribution.

Figure S1



NMR characterization or Assignment:

1: Toluene

2: Benzyl alcohol

3: $CDCl_3$

4: Aromatic compounds

5: 4-phenyl-2-butanone/4-phenyl-2-butanol

Figure S2

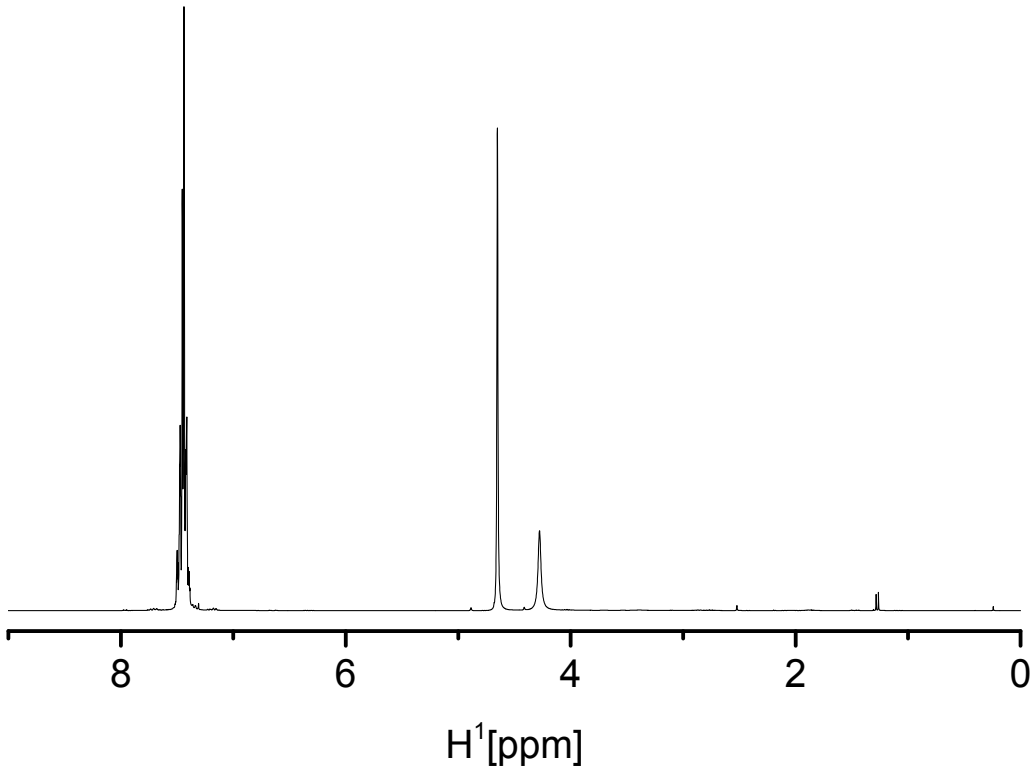


Figure S3

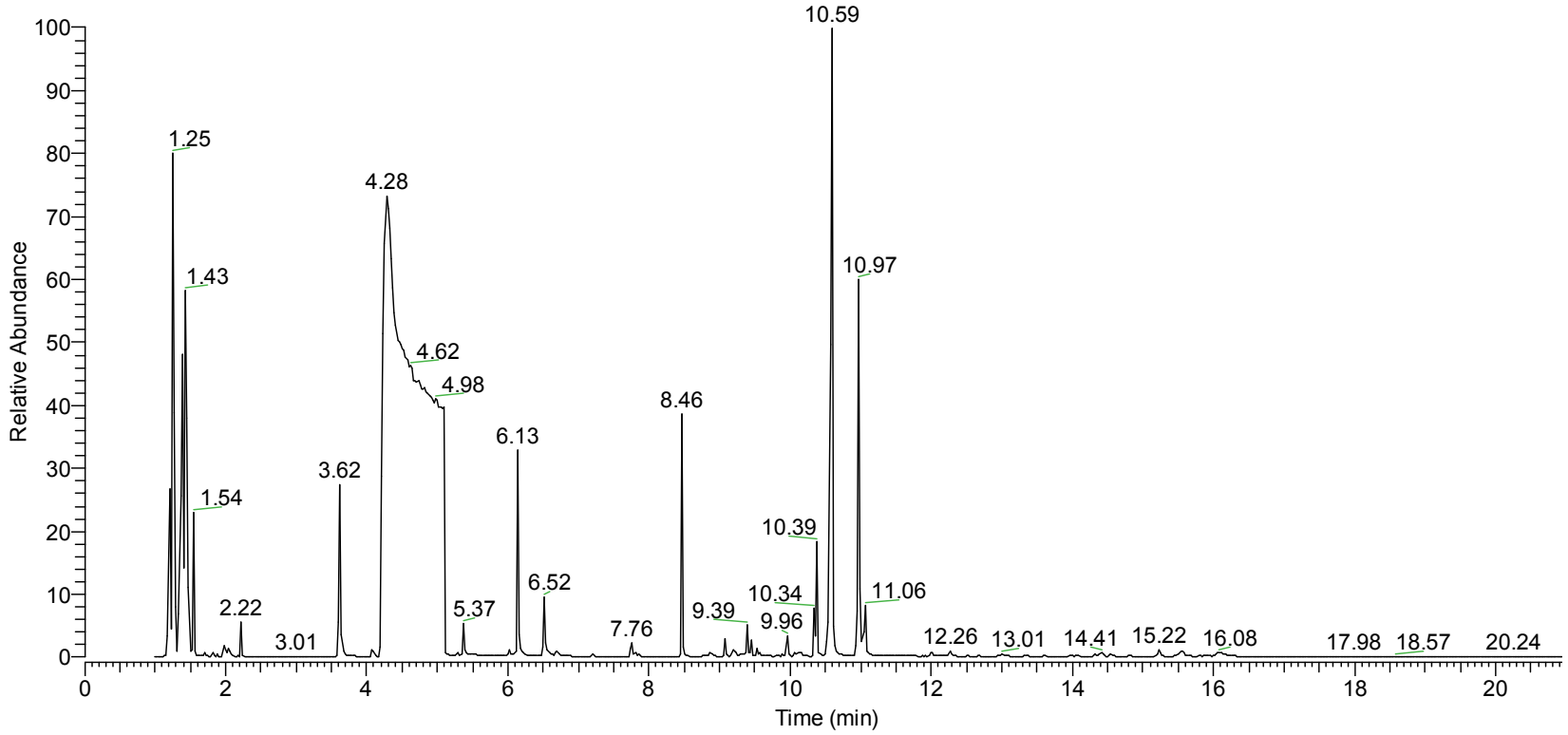
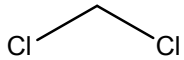
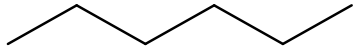
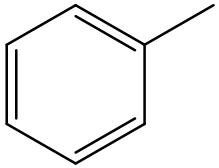
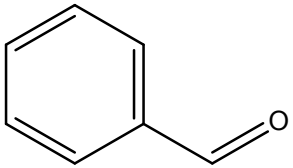
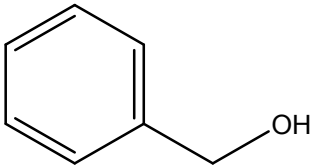
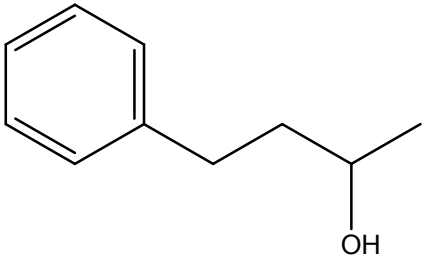

Relative Abundance
Time (min)
1.25
1.43
1.54
2.22
3.01
3.62
4.28
4.62
4.98
5.37
6.13
6.52
7.76
8.46
9.39
9.96
10.34
10.39
10.59
10.97
11.06
12.26
13.01
14.41
15.22
16.08
17.98
18.57
20.24

Table 1

Retention time / min	Compound	Obs.
1.25		*Dichloromethane*
1.43		*Hexane*
2.22		*Toluene*
3.62		*Benzaldehyde*
4.28		*Benzyl alcohol*
6.13		*4-phenyl-2-butanol*

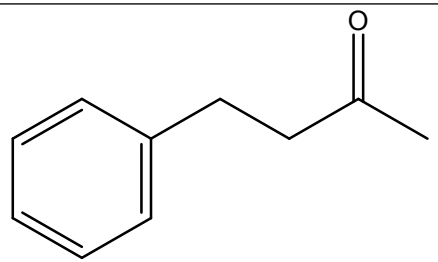
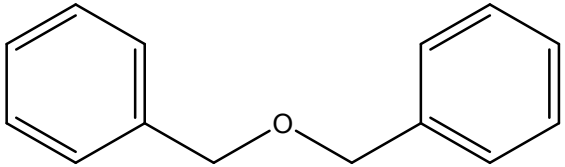
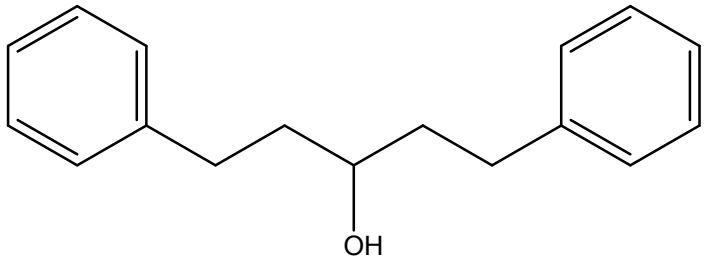
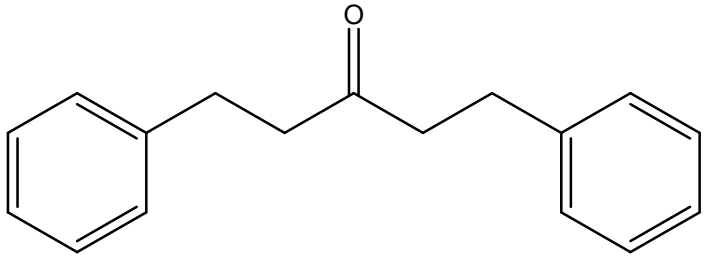
6.52		*4-phenyl-2-butanone*
8.46		*Benzyl ether*
10.59		*1,5-diphenyl-3-pentanol*
10.97		*1,5-diphenyl-3-pentanone*

Table 2

Sample	Agreement factors			Average crystalline domain diameter (nm)	Mode of the size distribution (nm)
	R_{wp} (%)	R_{exp} (%)	χ^2		
$SrHfO_3$	1.68	1.35	1.25	2.5(1)	2.0(1)