Speciation and structure of tin(II) in hyper-alkaline aqueous solution

Éva G. Bajnóczi,[a,h] Eszter Czeglédi,[a,h] Ernő Kuzmann,[b] Zoltán Homonnay,[b] Szabolcs Bálint,[c] György Dombi,[d] Péter Forgo,[d] Ottó Berkesi,[e] István Pálinkó,[f,h] Gábor Peintler,[e,h] Pál Sipos,[a,h*] and Ingmar Persson[g*]

[a] *Department of Inorganic and Analytical Chemistry, University of Szeged, H-6720 Dóm tér 7., Szeged, Hungary*

[b] *Laboratory of Nuclear Chemistry, Institute of Chemistry, Eötvös Loránd University, Budapest H-1117, Hungary*

[c] *Institute of Molecular Pharmacology, Research Centre for Natural Sciences, Hungarian Academy of Sciences, Pusztaszeri út 59-67, H-1025 Budapest, Hungary*

[d] *Institute of Pharmaceutical Analysis, University of Szeged, Somogyi u. 4, Szeged H-6720, Hungary*

[e] *Department of Physical Chemistry and Materials Science, University of Szeged, H-6720 Aradi vértanúk tere 1., Szeged, Hungary*

[f] *Department of Organic Chemistry, University of Szeged, H-6720 Dóm tér 8., Szeged, Hungary*

[g] *Department of Chemistry and Biotechnology, Swedish University of Agricultural Sciences, SE-750 07, Uppsala, Sweden*

[h] *Materials and Solution Structure Research Group, Institute of Chemistry, University of Szeged H-6720 Aradi vértanúk tere 1., Szeged, Hungary*

Electronic Supplementary Information

Table S1. Raman spectroscopic parameters of alkaline solutions containing Sn(II). The spectrum of the background solution has been subtracted.

$C_{Sn(II)}$ (M)	C_{NaOH} (M)	Band at ~430 cm^{-1}			Band at ~490 cm^{-1}		
		σ^a (cm^{-1})	FWHH[b] (cm^{-1})	I[c] (a.u.)	σ^a (cm^{-1})	FWHH[b] (cm^{-1})	I[c] (a.u.)
0.10	4.0	434.9	55	0.81	486.2	35	0.30
0.15	4.0	433.4	61	1.44	491.1	50	0.83
0.20	4.0	433.4	56	1.67	487.7	43	0.64
0.25	4.0	433.7	62	2.40	489.8	45	1.08
0.10	8.0	438.7	69	0.80	496.7	53	0.68
0.15	8.0	440.5	69	1.72	495.3	35	0.42
0.25	8.0	437.6	54	1.99	492.6	58	1.36
0.10	4.0[d]	430.6	70	1.00	490.2	52	0.63
0.20	4.0[d]	432.9	68	1.81	489.9	53	1.02
0.10	~14[d]	448	66	1.17	505	48	0.65

[a] Raman shift
[b] Full bandwidth at half height
[c] Peak intensity
[d] KOH instead of NaOH

Table S2. Mössbauer parameters obtained for rapidly frozen aqueous alkaline solutions containing Sn(II). Measurements were performed at 78 K.

$C_{Sn(II)}$ (M)	C_{NaOH} (M)	δ (mm/s)	Δ (mm/s)
0.01	0.1	2.60	2.08
0.1	1.0	2.59	2.03
0.1	4.0	2.58	2.01
0.2	4.0	2.59	2.00
0.2	4.0	2.47	1.87
0.2	12.0	2.55	2.02
0.5	8.0	2.61	1.83

δ and Δ denote the isomer shift and quadrupole splitting, respectively. The standard deviations are ±0.03 mm/s and ±0.06 mm/s for δ and Δ, respectively.

Table S3. Summary of solid state structures containing trichlorostannate, $[SnCl_3]^-$ or tetrachlorostannate, $[SnCl_4]^{2-}$ complexes. The list is based on the data collected from the Inorganic Crystal Structure Database (ICSD) and the Cambridge Structural Database (CSD).

Trichlorostannate(II)

ICSD/CSD code	d_{Sn-Cl}	Reference
PECOTB20	2.430 Å	Stalick, J. K.; Corfield, P. W. R; Meek, D. W. *Inorg. Chem.* **1973**, *12*, 1668.
PPECOT20	2.445 Å	Stalick, J. K.; Corfield, P. W. R; Meek, D. W. *Inorg. Chem.* **1973**, *12*, 1668.
DOWKIJ	2.453 Å	Fong, L. K.; Fox, J. R.; Foxman, B. M.; Cooper, N. J. *Inorg. Chem.* **1986**, *25*, 1880.
BIWLUP	2.466 Å	Hernandez-Molina, R.; Kalinina, I. V.; Abramov, P. A.; Sokolov, M. N.; Virovets, A. V.; Platas J. G.; Llusar, R.; Polo, V.; Vicent, C.; Fedin, V. P. *Inorg. Chem.* **2008**, *47*, 306.
SIGMEA	2.467 Å	Veith, M.; Godicke, B.; Huch, V. *Z. Anorg. Allg. Chem.* **1989**, *579*, 99.
VOGRAK	2.467 Å	Balch, A. L.; Neve, F.; Olmstead, M. M. *Inorg. Chem.* **1991**, *30*, 3395.
240910	2.468 Å	Szafranski, M.; Ståhl, K. *J. Solid State Chem.* **2007**, *180*, 2209-2215.
XETZUS	2.471 Å	Muller, U.; Mronga, N.; Schumacher, C.; Dehnicke, K. *Z. Naturforsch., Teil B* **1982**, *37*, 1122.
NAKPUK	2.474 Å	Constantine, S. P.; De Lima, G. M.; Hitchcock, P. B.; Keates, J. M.; Lawless, G. A. *Chem. Commun.* **1996**, 2337.
LAQVUU	2.480 Å	Faure, J.-L.; Gornitzka, H.; Reau, R.; Stalke, D.; Bertrand, G. *Eir. J. Inorg. Chem.* **1999**, 2295.
DUSWOD	2.481 Å	Drew, M. G. B.; Nicholson, D. G. *J. Chem. Soc., Dalton Trans.* **1986**, 1543.
SIGNIF	2.486 Å	Veith, M.; Godicke, B.; Huch, V. *Z. Anorg. Allg. Chem.* **1989**, *579*, 99.
ENCOSN	2.488 Å	Haupt, H. J.; Huber, F.; Preut, H. *Z. Anorg. Allg. Chem.* **1976**, *422*, 255.
KAYJOJ	2.500 Å	Hough, E.; Nicholson, D. G.; Vasudevan, A. K. *J. Chem. Soc., Dalton Trans.* **1989**, 2155.
170096	2.505 Å	Halfpenny, J. *Acta Crystallogr., Sect. C* **1996**, *52*, 340-342.
GIYGOK	2.507 Å	Kuhn, N.; Fawzi, R.; Kotowski, H.; Steimann. M. *Z. Kristallogr.-New Cryst. Struct* **1998**, *213*, 435.
KAHWAR	2.515 Å	Veith, M.; Huch, V.; Lisowsky, R.; Hobein, P. *Z. Anorg. Allg. Chem.* **1989**, *569*, 43.
14199	2.523 Å	Poulsen, F. R.; Rasmussen, S. E. *Acta Chem. Scand.* **1970**, *24*, 150-156.
BZSACS	2.527 Å	Elder, R. C.; Heeg, M. J.; Deutsch, E. *Inorg. Chem.* **1978**, *17*, 427.
GEHTUI	2.542 Å	Veith, M.; Jarczyk, M.; Huch, V. *Chem. Ber.* **1988**, *121*, 347.
30171	2.559 Å	Harrison, P. G.; Haylett, B. J.; King, T. J. *Inorg. Chim. Acta* **1983**, *75*, 265-270.
110664	2.567 Å	Yamada, K.; Kuranaga, Y.; Ueda, K.; Goto, S.; Okuda, T.; Furukawa, Y. *Bull. Chem. Soc. Jpn.* **1998**, *71*, 127-134.
14219	2.571 Å	Kamenar, B.; Grdenic, D. *J. Inorg. Nucl. Chem.* **1962**, *24*, 1039-1045.

1363	2.603 Å	Haupt, H. J.; Huber, F.; Sandbote, H. W. *Z. Anorg. Allgem. Chem.* **1977**, *435*, 191-196.
32593	2.605 Å	Golic, L.; Kaucic, V.; Trontelj, Z. *Docum. Chem. Yugoslav. Vestnik Sloven. Kemi. Drustva* **1979**, *26*, 425-434.
415711	2.610 Å	Abraham, I.; Demetriou, D. Z.; Vordemvenne, E.; Mustarde, K.; Benoit, D. M. *Polyhedron* **2006**, *25*, 996-1002.
110663	2.637 Å	Yamada, K.; Kuranaga, Y.; Ueda, K.; Goto, S.; Okuda, T.; Furukawa, Y. *Bull. Chem. Soc. Jpn.* **1998**, *71*, 127-134.
Average	**2.513 Å/27 structures**	

Tetrachlorostannate(II)

VIZJET	2.634 Å	Sokol, V. I.; Vasilenko, T. G.; Porai-Koshits, M. A.; Molodkin, A. K.; Vasnin, S. V. *Zh. Neorg. Khim.* **1990**, *35*, 2017.
Average	**2.634 Å/1 structure**	

Table S4 The oxygen coordinated tin(II) structures used for determine the coordination number – Sn-O bond distance relationship for coordination numbers = 2, 3, 4, 5, 6, 8. The list is based on the data collected from the Inorganic Crystal Structure Database (ICSD) and the Cambridge Structural Database (CSD); *N* = coordination number; references marked in red text are omitted from the mean bond distance and angle.

N	CSD code	d_{Sn-O}	∠O-Sn-O	Reference
2	BOSSIM	1.964 Å,	99.5 ^{o}	Nembenna, S.; Singh, S.; Jana, A.; Roesky, H. W.; Ying Yang, Hongqi Ye; Ott, H.; Stalke, D. *Inorg. Chem.* **2009**, *48*, 2273.
2	PAQHIY	1.992 Å	95.6 ^{o}	Hascall, T.; Rheingold, A. L.; Guzei, I.; Parkin, G. *Chem. Commun.* **1998**, 101.
2	HEBXOB	2.024 Å	88.8 ^{o}	Barnhart, D. M.; Clark, D. L.; Watkin, J. G. *Acta Crystallogr., Sect.C* 1994, 50, 702.
2	HEBXOB01	2.026 Å	89.0 ^{o}	Boyle, T. J.; Doan, T. Q.; Steele, L. A. M.; Apblett, C.; Hoppe, S. M.; Hawthorne, K.; Kalinich, R. M.; Sigmund, W. M. *Dalton Trans.* **2012**, *41*, 9349.
2	LIXLUA	2.041 Å	87.3 ^{o}	Dickie, D. A.; MacIntosh, I. S.; Ino, D. D.; Qi He; Labeodan, O. A.; Jennings, M. C..; Schatte, G.; Walsby, C. J.; Clyburne, J. A. C. *Can. J. Chem.* **2008**, *86*, 20.
2	PEBVIC	2.047 Å	92.2 ^{o}	Stanciu, C., Richards, A. F.; Stender, M; .Olmstead, M. M.; Power, P. P *Polyhedron* **2006**, *25*, 477.

2	NINSIN	2.069 Å	89.4 ^{o}	Hascall, T.;Keliang Pang;Parkin, G. *Tetrahedron* **2007**, *63*, 10826.	
2	JOQBOG	2.104 Å	73.0 ^{o}	McBurnett, B. G.; Cowley A. H. *Chem. Commun.* **1999**, 17.	
Average		**2.023 Å/7 structures**			

2	DASJEM		Fjeldberg, T.; Hitchcock, P. B.; Lappert, M. F.; Smith, S. J.; Thorne, A. J. *Chem. Commun.* **1985**, 939.
2	TBMGEB		Cetinkaya, B.; Gumrukcu, I.; Lappert, M. F.; Atwood, J. L.; Rogers, R. D.; Zaworotko, M. J. *J. Am. Chem. Soc.* **1980**, *102*, 2088.

3	$Na_4[Sn(OH)_3]_2$-$[Sn_2O(OH)_4]$	35420	2.080 Å	88.1 ^{o}	von Schnering, H.G.; Nesper, R.; Pelshenke, H. *Z. Anorg. Allgem. Chem.* **1983**, *499*, 117-129
3	$Na_4[Sn(OH)_3]_2$-$[Sn_2O(OH)_4]$	35420	2.066 Å	89.3 ^{o}	von Schnering, H.G.; Nesper, R.; Pelshenke, H. *Z. Anorg. Allgem. Chem.* **1983**, *499*, 117-129
3	$Sn_3O(OH)_2(SO_4)$	4294	2.122 Å	89.2 ^{o}	Grimvall, S. *Acta Chem. Scand., Ser. A* **1975**, 29, 590-598.
3	$Sn_3O(OH)_2(SO_4)$	15778	2.127 Å	89.6 ^{o}	Davies, C. G.; Donaldson, J. D.; Laughlin, D. R.; Howie, R. A.; Beddoes, R. *J. Chem. Soc., Dalton Trans.*, **1975**, 2241-2244.
3	$Sn_3O(OH)(PO_4)$	23339	2.135 Å	83.8 ^{o}	Jordan, T. H.; Dickens, B.; Schroeder, L. W.; Brown, W. E. *Inorg. Chem.* **1980**, *19*, 2551-2556.
3	$Sn_3O(OH)(PO_4)$	23339	2.171 Å	84.8 ^{o}	Jordan, T. H.; Dickens, B.; Schroeder, L. W.; Brown, W. E. *Inorg. Chem.* **1980**, *19*, 2551-2556.
Average			**2.117 Å**	**87.5 ^{o}/6 structures**	

4	SnO	26597	2.211 Å	89.2 ^{o}	Moore, W. J.; Pauling, L. *J. Am. Chem. Soc.* **1941**, *63*, 1392-1394.
4	SnO	15516	2.219 Å	88.9 ^{o}	Izumi, F. *J. Solid State Chem.* **1981**, *38*, 381-385.
4	SnO	41954	2.222 Å	88.8 ^{o}	Moreno, M. S.; Mercader, R. C. *Phys. Rev. B* **1994**, *50*, 9875-9881.
4	SnO	16481	2.224 Å	88.8 ^{o}	Pannetier, J.; Denes, G. *Acta Crystallogr., Sect. B* **1980**, *36*, 2763-2765.

4	SnO	185350	2.224 Å	88.7 ^{o}	Allen, J. P.; Scanlon, D. O.; Parker, S. C.; Watson, G. W. *J. Phys. Chem. C* **2011**, *115*, 19916-19924.
4	$Sn_3O(OH)(PO_4)$	23339	2.246 Å	91.6 ^{o}	Jordan, T. H.; Dickens, B.; Schroeder, L. W.; Brown, W. E. *Inorg. Chem.* **1980**, *19*, 2551-2556.
4	$Sn_3O(OH)_2O(SO_4)$	15778	2.273 Å	89.3 ^{o}	Davies, C. G.; Donaldson, J. D.; Laughlin, D. R.; Howie, R. A.; Beddoes, R. *J. Chem. Soc., Dalton Trans.*, **1975**, 2241-2244.
Average			**2.224 Å**	**89.3 ^{o}/6 structures**	

N	CSD code	d_{Sn-O}	∠O-Sn-O	Reference
3	FEKTOF	2.085 Å	85.0 ^{o}	Veith, M.; Ehses, M.; Huch, V. *New J. Chem.* **2005**, *29*, 154-164.
3	DUVNIR	2.092 Å	88.8 ^{o}	Veith, M.; Rosler, R. *Z. Naturforsch., Teil B* **1986**, *41*, 1071.
3	DEPQEV	2.093 Å	86.6 ^{o}	Ramaswamy, P.; Natarajan, S. *Eur. J. Inorg. Chem.* **2006**, 3463-3471.
3	DUVNOX	2.094 Å	87.1 ^{o}	Veith, M.; Rosler, R. *Z. Naturforsch., Teil B* **1986**, *41*, 1071.
3	FEKTUL	2.096 Å	85.5 ^{o}	Veith, M.; Ehses, M.; Huch, V. *New J. Chem.* **2005**, *29*, 154-164.
3	DASHUA	2.101 Å	79.7 ^{o}	Fjeldberg, T.; Hitchcock, P. B.; Lappert, M. F.; Smith, S. J.; Thorne, A. J. *J. Chem. Soc., Chem. Commun.* **1985**, 939-941.
3	JIYPIQ	2.102 Å	79.3 ^{o}	Ayyappan, S.; Bu, X.; Cheetham, A. K.; Natarajan, S.; Rao, C. N. R *Chem. Commun.***1998**, 2181-2182.
3	DUVNOX	2.106 Å	86.8 ^{o}	Veith, M.; Rosler, R. *Z. Naturforsch., Teil B* **1986**, *41*, 1071.
3	JOTHOP	2.111 Å	86.9 ^{o}	Natarajan, S.; Eswaramoorthy, M.; Cheetham, A. K.; Rao, C. N. R. *Chem. Commun.* **1998**, 1561-1562.
3	BIFJOQ	2.115 Å	86.0 ^{o}	Duchateau, R.; Dijkstra, T. W.; Severn, J. R..; van Santen, R. A.; Korobkov, I. V. *Dalton Trans.* **2004**, 2677-2682.
3	GIVDOE	2.116 Å	86.5 ^{o}	Ayyappan, S.; Cheetham, A. K.; Natarajan, S.; Rao, C. N. R. *J. Solid State Chem.* **1998**, *139*, 207-210.
3	JOQBEW	2.126 Å	80.9 ^{o}	McBurnett, B. G.; Cowley, A. H. *Chem. Commun.* **1999**, 17-18.
3	JOQBEW	2.139 Å	80.0 ^{o}	McBurnett, B. G.; Cowley, A. H. *Chem. Commun.* **1999**, 17-18.
3	KAFHEE	2.150 Å	76.0 ^{o}	Smith, G. D.; Fanwick, P. E.; Rothwell, I. P. *Inorg. Chem.* **1989**, *28*, 618-620.

3	BIDWIV	2.159 Å	84.9 ^{o}	Reuter, H. *Z. Kristallogr.-New Cryst. Struct.* **2004**, *219*, 109-110.
3	COHVEA	2.184 Å	79.4 ^{o}	Arifin, A.; Filmore, E. J.; Donaldson, J. D.; Grimes, S. M. *J. Chem. Soc., Dalton Trans.* **1984**, 1965-1968.
	Average:	**2.112 Å**	**84.0 ^{o}/15 structures**	

N	CSD code	d_{Sn-O}	∠O-Sn-O	Reference
4	SUXLAY	2.195 Å	89.0 ^{o}	Barret, M. C.; Mahon, M. F.; Molloy, K. C., Steed, J. W.; Wright, P. *Inorg. Chem.* **2001**, *40*, 4384-4388.
4	YERBON	2.199 Å	97.2 ^{o}	Ionkin, A. S.; Marshall, W. J.; Fish, B. M. *Organometallics* **2006**, *25*, 4170-4178.
4	PBONSN	2.216 Å	94.2 ^{o}	Ewings, P. F. R.; Harrison, P. G.; King, T. J. *J. Chem. Soc., Dalton Trans.* **1975**, 1455-1458.
4	SIHQOP	2.221 Å	90.4 ^{o}	Ayyappan, S.; Cheetham, A. K.; Natarajan, S.; Rao, C. N. R. *Chem. Mater.* **1998**, *10*, 3746-3755.
4	WIDCAN	2.221 Å	92.2 ^{o}	Pettinari, C.; Marchetti, F.; Cingolani, A.; Marciante, C.; Spagna, R.; Colapietro, M. *Polyhedron* **1994**, *13*, 939-950.
4	XEXSUP	2.222 Å	83.5 ^{o}	Piskunov, A. V.; Lado, A. V.; Fukin, G. K.; Baranov, E. V.; Abakumova, L. G.; Cherkasov, V. K.; Abakumov, G. A. *Heteroat. Chem.* **2006**, *17*, 481-490.
4	SUXKUR	2.225 Å	91.9 ^{o}	Barret, M. C.; Mahon, M. F.; Molloy, K. C., Steed, J. W.; Wright, P. *Inorg. Chem.* **2001**, *40*, 4384-4388.
4	ABIBIX	2.230 Å	91.3 ^{o}	Pettinari, C.; Marchetti, F.; Pettinari, R.; Cingolani, A.; Rivarola, E.; Phillips, C.; Tanski, J.; Rossi, M.; Caruso, F. *Eur. J. Inorg. Chem.*, **2004**, 3484-3497.
4	DPPRSN	2.231 Å	90.7 ^{o}	Uchida, T.; Kozawa, K.; Obara, H. *Acta Crystallogr., Sect. B.* **1977**, *33*, 3227-3229.
4	KSNOXL	2.233 Å	88.9 ^{o}	Christie, A. D.; Howie, R.A.; Moser, W. *Inorg. Chim. Acta* **1979**, *36*, L447-L448.
4	AGEBIX	2.240 Å	98.0 ^{o}	Boyle, T. J.; Alam, T. M.; Rodriguez, M. A.; Zechmann, C. A. *Inorg. Chem.* **2002**, *41*, 2574-2582.
4	XEXSUP	2.247 Å	87.9 ^{o}	Piskunov, A. V.; Lado, A. V.; Fukin, G. K.; Baranov, E. V.; Abakumova, L. G.; Cherkasov, V. K.; Abakumov, G. A. *Heteroat. Chem.* **2006**, *17*, 481-490.
4	NOWWAX	2.256 Å	90.3 ^{o}	Deacon, P. R.; Mahon, M. F.; Molloy, K. C.; Waterfield, P. C. *J. Chem. Soc., Dalton Trans.* **1997**, 3705-3712.
4	XEXSUP	2.273 Å	88.2 ^{o}	Piskunov, A. V.; Lado, A. V.; Fukin, G. K.; Baranov, E. V.; Abakumova, L. G.; Cherkasov, V. K.; Abakumov, G. A. *Heteroat. Chem.* **2006**, *17*, 481-490.

4	CIXSUY	2.279 Å	87.1 ^{o}	Ramaswamy, P.; Datta, A.; Natarajan, S. *Eur. J. Inorg. Chem.* **2008**, 1376-1385.
4	TINOXL	2.311 Å	86.9 ^{o}	Christie, A. D.; Howie, R.A.; Moser, W. *Inorg. Chim. Acta* **1979**, *36*, L447-L448.
	Average:	**2.233 Å**	**90.7 ^{o}/15 structures**	

N	CSD code	d_{Sn-O}	Reference
5	KAKBEF	2.380 Å	Zabula, A. V.; Filatov, A. S.; Petrukhina, M. A. *J. Cluster Sci*. **2010**, *21*, 361-370.
5	KAKBEF	2.380 Å	Zabula, A. V.; Filatov, A. S.; Petrukhina, M. A. *J. Cluster Sci*. **2010**, *21*, 361-370.
5	KAKBEF	2.383 Å	Zabula, A. V.; Filatov, A. S.; Petrukhina, M. A. *J. Cluster Sci*. **2010**, *21*, 361-370.
5	KAKBEF	2.383 Å	Zabula, A. V.; Filatov, A. S.; Petrukhina, M. A. *J. Cluster Sci*. **2010**, *21*, 361-370.
5	OFACSO	2.392 Å	Birchall, T.; Johnson, J. P. *J. Chem. Soc., Dalton Trans.* **1981**, 69-73.
	Average:	**2.384 Å/5 structures**	

N	CSD code	d_{Sn-O}	Reference
6	CIXTIN	2.394 Å	Ramaswamy, P.; Datta, A.; Natarajan, S. *Eur. J. Inorg. Chem.* **2008**, 1376-1385.
6	SIHQEF	2.415 Å	Ayyappan, S.; Cheetham, A. K.; Natarajan, S.; Rao , C. N. R. *Chem. Mater.* **1998**, *10*, 3746-3755.
6	XEXSAU	2.423 Å	Natarajan, S.; Vaidhyanathan, R.; Rao, C. N. R.; Ayyappan, S.; Cheetham, A. K. *Chem. Mater.* **1999**, *11*, 1633-1639.
6	XEXRUN	2.424 Å	Natarajan, S.; Vaidhyanathan, R.; Rao, C. N. R.; Ayyappan, S.; Cheetham, A. K. *Chem. Mater.* **1999**, *11*, 1633-1639.
6	NTBZSN10	2.441 Å	Ewings, P. F. R.; Harrison, P. G.; Morris, A.; King, T. J. *J. Chem. Soc., Dalton Trans.*,**1976**, 1602-1608.
6	FOTDEX	2.481 Å	Holt, E. M.; Klaui, W.; Zuckerman, J. J. *J. Organomet. Chem.* **1987**, *335*, 29-42.
6	HATCIQ	2.498 Å	Macdonald, C. L. B.; Bandyopadhyay, R.; Cooper, B. F. T.; Friedl, W. W.; Rossini, A. J.; Schurko, R. W.; Eichhorn, S. H.; Herber, R. H. *J. Am. Chem. Soc.* **2012**, 134, 4332-4345.
6	HATCOW	2.523 Å	Macdonald, C. L. B.; Bandyopadhyay, R.; Cooper, B. F. T.; Friedl, W. W.; Rossini, A. J.; Schurko, R. W.; Eichhorn, S. H.; Herber, R. H. *J. Am. Chem. Soc.* **2012**, 134, 4332-4345.
	Average:	**2.450 Å/8 structures**	

N	CSD code	$d_{Sn\text{-}O}$	Reference
8	VUTHUO	2.597 Å	Bandyopadhyay, R.; Cooper, B. F. T.; Rossini, A. J.; Schurko, R. W.; Macdonald, C. L. B. *J. Organomet. Chem.* **2010**, *695*, 1012-1018.
	Average:	**2.597 Å/1 structure**	

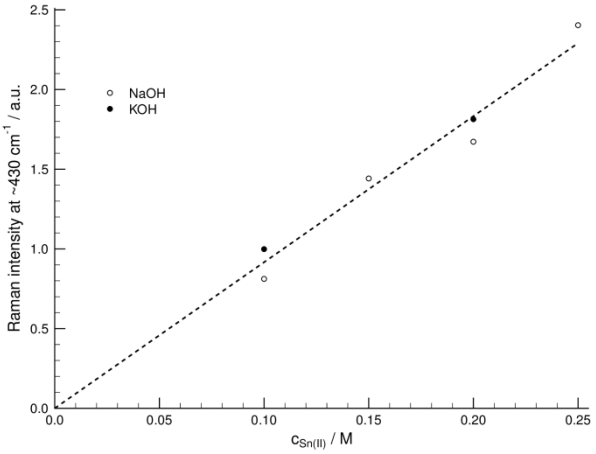

Figure S1. Integrated Raman band intensities for the mode at ~430 cm^{-1}, after background subtraction and deconvolution, as a function of the $C_{Sn(II)}$.

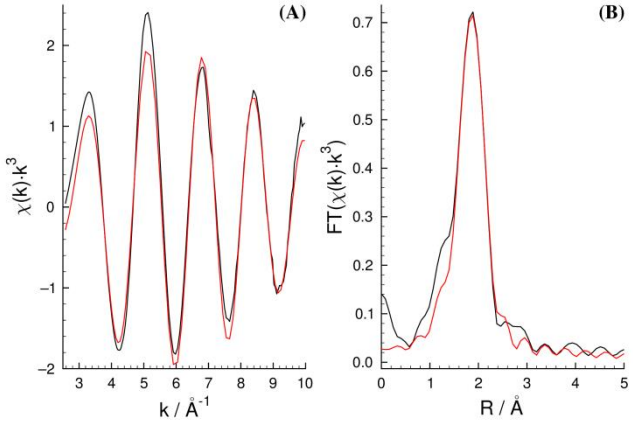

Figure S2. The experimental EXAFS spectrum of the Sn K-edge X-ray absorption spectra of 0.1 mol·dm^{-3} $SnCl_2$ in 1 mol·dm^{-3} hydrochloric acid (black) and the fitted spectrum (red) (A) and the Fourier-transform of the k^3-weighted EXAFS data of it and the fitted data (B).