Analytical and Bioanalytical Chemistry

Electronic Supplementary Material

Porous matrix materials in optical sensing of gaseous oxygen

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1. Abbreviations

1.1. Dyes/Ligands

TMS-DAP	*N*-(3-trimethoxysilylpropyl)-2,7-diazapyrenium bromide
PBA	pyrene butylic acid
C480	Coumarin 480
PtCN(L)	Cyanido-(*κ*3CNN-*N*-(6-phenylpyridin-2-yl)-*N*-propyl-thiazol-2-amino)-platinum(II)
AlQ_3	tris(8-hydroxyquinolinato)aluminium

Polypyridyl ligands

dpp	4,7-diphenyl-1,10-phenanthroline
dC_8pp	4,7-(bis-4-octylphenyl)-1,10-phenanthroline
phen	1,10-phenanthroline
bpy/phen -Si	Bpy or phen ligand linked to trialkoxysilanes via an alkyl chain linker
$diC_{19}phen$	4,7-dinonadecyl-1,10-phenanthroline
ppy	2-phenylpyridine
4-cppy	2-(4-carboxyphenyl)pyridine
F_2ppy	2-(2,4-difluorophenyl)pyridine
bpy	2,2'-bipyridine
Brbpy	4-bromo-2,2'bipyridine
$Bpy\text{-}NH_2$	3-amino-2,2'-bipyridine
4-dcbpy	4,4'-dicarboxy-2,2'-bipyridine
5- dcbpy	5,5'-dicarboxy-2,2'-bipyridine
Me_4dabpy	$N^4,N^4,N^{4'},N^{4'}$-tetramethyl-(4,4'-diamine-2,2'-bipyridine)
DMCH	6,7-dihydro-5,8-dimethyl-dibenzo-[*i*,*j*][1,10]-phenanthroline
OMCH	5,8-dimethyl-dibenzo-[*i*,*j*][1,10]-phenanthroline
iphen	1H-imidazo[4,5-f]-[1,10]phenanthroline
pip	2-phenyl-1H-imidazo[4,5-f]-[1,10]phenanthroline
epip	1-ethyl-2-phenyl-1H-imidazo[4,5-f][1,10]phenanthroline
nip	2-(naphthalen-1-yl)-1H-imidazo[4,5-f][1,10]phenanthroline
Phencarz	2-(*N*-ethyl-carbazole-yl-4)imidazo[4,5-f]1,10-phenanthroline
eCl-phen	1-ethyl-2-(*N*-ethyl-carbazole-yl-4)imidazo[4,5-f]1,10-phenanthroline

Porphyrins

H_2OEP	2,3,7,8,12,13,17,18-octaethyl--21*H*,23*H*-porphyrin
H_2BP	tetrabenzo-21*H*,23*H*-porphyrine
H_2TPP	5,10,15,20-tetraphenyl-21*H*,23*H*-porphyrin
H_2TCPP	5,10,15,20-tetrakis-(4-carboxyphenyl) -21*H*,23*H*-porphyrin
H_2CTPP	5-(4-carboxyphenyl)-10,15,20-triphenyl-21*H*,23*H*-porphyrin
$H_2TCBPyP$	5,10,15,20-tetra{4-[(Ncarbazyl)butyloxyphenyl]}porphyrin
$H_2TMCUPP$	5,10,15,20-tetrakis-[4-(11-methoxycarbonylundecane-1-oxy)phenyl]- 21*H*,23*H*-porphyrin
$H_2MCUTPP$	5-[4-(11-methoxycarbonylundecane-1-oxy)phenyl]-10,15,20-triphenyl-21*H*,23*H*-porphyrin
H_2TFPP	tetrakis(pentafluorophenyl) -21*H*,23*H*-porphyrin
H_2TPPMA	10,15,20-triphenyl-5-(2-(methacryloyloxy)ethyl benzoate) -21*H*,23*H*-porphyrin
H_2PyP	tetrapyridinie-21*H*,23*H*-porphyrin
H_2MPyP	tetra(*N*-methyl-pyridinie)-21*H*,23*H*-porphyrin
$H_2PC_{10}COOH$	[5-(1-carboxydecyl-4-pyridyl(10,15,20-tritoloyl-21*H*,23TMMB 1,3,5-tris[2-(2′-pyridyl)benzimidazoyl] methylbenzene
dpephos	bis[2-(diphenylphosphanyl)phenyl] ether
POP	bis[2-(diphenylphosphino)phenyl]ether
TTA	2-theonyltrifluoroacetate
Pyr	1-pyrenol
$1,4\text{-}H_2NDC$	1,4-naphthalenedicarboxylic acid
HS^tBu	*tert*-buthylthiol
Ferron	8-hydroxy-7-iodo-5-quinolinesulfonic acid
Tfpb	tetrakis (bis-3, 5-trifluoromethylphenylborate)

$BisPh_2PPh$	bis(2-(diphenylphosphanyl)phenyl)ether
PPh_3	triphenylphosphane

1.2. polymers

PMMA	poly(methyl methacrylate)
pPFPA	poly(pentafluorophenyl acrylate)
pOCFPM	poly(octafluoropentyl methacrylate)
PS	polystyrene
pPFS	poly(pentafluorostyrene)
EC	ethylcellulose
O-PP	oxidized polypropylene
PEG	polyethyleneglycole
PVA	polyvinyl alcohol
pTMSP	poly[1-(trimethylsilyl)-1-propyne]

1.3. Sol-gel precursors

TMOS	tetramethoxysilane
TEOS	tetraethoxysilane
MTMOS	methyltrimethoxysilane
MTEOS	methyltriethoxysilane
alkyl-triMOS	alkyltrimethoxysilane
alkyl-triEOS	alkyltriethoxysilane
TFP-triMOS	3,3,3-trifluoropropyltrimethoxysilane
PFPh-triMOS	3-pentafluorophenylpropyl trimethoxysilane
PhE-triMOS	2-phenylethyltrimethoxysilane

1.4. Miscellaneous

NW	nanowire
CD	carbon dot
NP	nanoparticle
UCNP	up-conversion nanoparticle
Apd	average pore diameter

2. Overview of commercial availability of described matrix materials

Table S1. *Overview of porous and nonporous oxygen sensing materials is respect to their commercial availability and manufacturing effort*

Material type	**Commerical availability**	**Common name(s)**	**Preparation effort**
Silica gel beads	Yes	Partisil^{TM}, Silica gel	n.a.
Mesoporous silica	Yes	MCM-41, SBA-15	Medium (Template synthesis from TEOS and surfactant, followed by washing and calcination)
Silica aerogels	No		High (sol-gel process with drying in supercritical CO_2)
Sol-gels (silica- and Ormosil-based)	No		Medium (sol-gel process; tuning of conditions has influence on properties)
MOFs	Some	Respective MOF name (ZIF-8, HKUST-1, PCN-224,…)	Medium to high (Usually solvothermal synthesis, conditions can affect morphology)
Electrospun nanofibers	No		Medium (extrude polymer solution under high voltage)
Porous anodized alumina	Yes	Porous anodized alumina, AAO	Medium (electrochemical oxidation under acidic conditions)
Non-porous polymers (like polystyrene)	Yes	Poly(styrene)	Low (coating of solution of the dye and polymer solution in organic solvent)
Perfluorinated amorphous polymers (Teflon AF, Hyflon AD)	Yes	Polymer name or trademark names (Hyflon AD,…)	Low to high (simple coating as in case of non-porous polymers, but synthesis of compatible dyes may be challenging)

Silicone rubber	Yes	E4, RTV-silicone, Silicone rubber	Low to high (polymerization/crosslinking from commercially available precursors). Synthesis of dyes may be challenging.

3. Summary on the porosity and sensing properties for sensors based on different classes of porous matrix materials[1]

Table S2. *Overview of oxygen sensing materials based on silica aerogel matrices*

Indicator	Matrix	Porosity	K_{SV} / kPa^{-1}	k_q / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
TMS-DAP$^+$	TMOS	N_2 BET: 870 m^2g^{-1}	0.005	330	<8	?	[66]
$Ru(phen)_3$ donor-acceptor dyads	TMOS	N_2 BET: 1000 m^2g^{-1}	2.5	1020	<8	No (0-<10%)	[67]
$Ru(dpp)_3$ [a)]	TMOS aerogel		14	2800	<10	No (0-<5%)	[68]
$Ru(dpp)_3$ [a)]	TMOS xerogel		10	2000	<50		
PtOEP [a)]	TMOS aerogel		0.5	5	<10	No (0-5.5%)	

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

Table S3. *Overview of oxygen sensing materials based on silica-gel with surface-adsorbed indicators*

Indicator	Matrix	Porosity	K_{SV} / kPa^{-1}	k_q / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
Perylene tetracarboxylic acid bisimidesa)	Silica (TLC plate)		0.08	16000	-	?	[26]
$Ru(bpy)_2(DMCH)$ $Ru(bpy)(DMCH)_2$ $Ru(bpy)_2(OMCH)$ $Ru(dpp)(DMCH)_2$	Silica (Partisil 5) in E4 silicone PVC E4 silicone	350 m^2g^{-1}, 85 Å apd	0.021 0.021 0.045 0.018 0.02	60 40 120 30 30	35 1 1	No (0-<20%)	[28]

[1] For simplified navigation the reference numbers are identical to those in the Review.

$Ru(bpy)_3$ [a)]	Silica gel in silanol-silanol condensed PDMS Silica gel in vinyl-hydride condensed PDMS		0.02 0.03	20 30		No	[27]
$Ru(bpy)_3$ [a)] $Ru(phen)_3$ [a)] $Ru(dpp)_3$ [a)]	Cab-O-Sil fumed silica discs	196 m^2g^{-1}	0.29 0.83 1.4	290 330 280		No (0-<5%)	[16]
$Ru(odap)_3$ [c)]	silicone Partisil in silicone C-18 silica in silicone CPG in silicone Amberlite XAD-4 in silicone	 350 m^2g^{-1}, 85 Å apd 500 m^2g^{-1}, 60 Å apd 200-400 mesh, 75 Å apd 750 m^2g^{-1}, 100 Å	0.01 0.10 0.02 0.14 0.03	10 210 40 290 60		Yes No	[29]
$Ru(dpp)_3$ [a)]	Silicone Fumed silica LM-130 in silicone Fumed silica HS-5 in silicone Fumed silica EH-5 in silicone	 130 m^2g^{-1} 325 m^2g^{-1} 380 m^2g^{-1}	0.05 0.13 0.13 0.13	10 30 30 30	25 / 48 27 / 64 30 / 74 24 / 72	No (K_q calculated from I_0/I_{100})	[138]
$Ru(bpy)_3$ [a)]	Mesoporous silica	550 m^2g^{-1}	0.01	11	120-240	No	[139]
PdOEP PtOEP PtTFPP	SBA-15	960 m^2g^{-1} 89 Å apd	48 4.7 1.5	50 60 20		No	[13]

PtTPP			2.2	30			
$Ru(dpp)_3$			0.4	50			
$Ru(phen)_2(phen\text{-}CH_3)$			0.2	50			
$Ru(phen)_3$			0.3	90			
$Ru(bpy)_3$			0.1	90			
$PtMPyP^{4+}$ a)	MCM-41		5	100	0.75 / 204	No	[38]
PtPyP a)			0.33	7	0.33 / 26.62		
$Ru_3(bpy)_6TMMB$	SBA-15		0.10	100	3 / 30	No (0-<10%)	[39]
	MCM-41		0.06	60			
$Ru_3(phen)_6TMMB$	SBA-15		0.21	80			
	MCM-41		0.20	80			
$[Cu(dpephos)(pip)]BF_4$	MCM-41		0.4	50	8 / 180	No (0-<1%)	[40]
	SBA-15		2.0	250			
$[Cu(dpephos)(epip)]BF_4$	MCM-41		0.8	400			
	SBA-15		2.0	1030			
$[Cu(dpephos)(nip)]BF_4$	MCM-41		0.5	65			
	SBA-15		3.5	500			
$[Cu(dpephos)(enip)]BF_4$	MCM-41		0.8	340			
	SBA-15		1.6	680			
$[\{Re(CO)_3(diC_{19}phen)\}_2(bpy)](OTf)_2$	MCM-41		0.3	70	19 / 41	No (0-<10%)	[41]
	SBA-15		1.3	160	7 / 43		
$Ru(dpp)_3$ a)	Silica in Octyl-triEOS/TEOS	250 m^2g^{-1}, 19.5 Å apd	0.25	50		Yes	[140]
	Octyl-triEOS/TEOS		0.03	5			
PtTFPP a)	Ag-coated silica in Octyl-triEOS/TEOS	250 m^2g^{-1}, 19.5 Å apd	1.6	20	2.6 / 36	No (~0-20%, k_q calculated from I_0/I_{100})	[141]
	Octyl-triEOS/TEOS		0.2	2	1.1 / 5.5	Yes	

$[Cu(PTO)(PPh_3)_2]BF_4$	MCM-41		0.9	13	9 / 37	No (0-<10%)	[42]
PtTCBPP [a)]	MCM-41 SBA-15		354 130	3500 1300	3 / 17 1.5 / 14.5	No (0-<10%)	[43]
PtTFPP	Silica gel	480 m^2g^{-1}, 60 Å apd	0.3	7	4 / 7	Yes (0-20%)	[33]

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

c) τ_0 only given for methanolic dye solution

Table S4. *Overview of oxygen sensing materials based on indicator covalently coupled to silica-gel*

Indicator	Matrix	Porosity	K_{SV} / kPa^{-1}	k_q / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
Erythrosine B isocyanate (covalently grafted)	Amino-functionalized silica (Bondesil)	500 m^2g^{-1}, 60 Å apd	66	230	<2s	No	[31]
Erythrosine B (adsorbed)	Amberlite XAD-2 Amberlite XAD-4	300 m^2g^{-1}, 90 Å 750 m^2g^{-1}, 100 Å	1.6 1.7	2 2	<2s	No	[137]
$Ru(bpy)_2$(phen-Si-) (covalently grafted)	MCM-41 Amorphous silica/		0.13 0.08	74 53	4 / 10	Yes	[35]
$Ru(bpy)_2$(phen) (adsorbed)	MCM-41 Amorphous silica		0.47 0.35	340 210	4 / 10	No (0-<10%)	[35]
$Ru(dpp)_2$(phen-Si-) (covalently grafted) $Ru(dpp)_2$(phen) (adsorbed)	MCM-41 SBA-15 MCM-41 SBA-15	706 m^2g^{-1}, 71.3 Å apd 615 m^2g^{-1} 69.6 Å apd 1209 m^2g^{-1} 32.7 Å apd 765 m^2g^{-1} 31.2 Å apd	2.0 0.62 0.74 0.28	280 190 120 90	7.5 / 22.5 11.5 / 47.5 3.2 / 20.6 4 / 27.5	No	[36]
$Ru(dpp)_2$(bpy-Si)	MCM-41		3.1	920	1.2 / 29	No (0-1.4%)	[37]
PtTFPP PdTFPP	Silica gel in E4 silicone (adsorbed) Amine-modified silica gel in E4 silicone (covalent) Silica gel in E4 silicone (adsorbed)	500 m^2g^{-1}, 60 Å apd (unmodified silica gel)	3.9 3.5 63	55 50 65	0.15	Yes	[32]

	Amine-modified silica gel in E4 silicone (covalent)		62	65			
Ir-OEP-(n-ButIm)$_2$ Ir-OEP-(CarbIm)$_2$ (covalently grafted)	PS Amino modified silica	550 m^2g^{-1}, 60 Å apd (unmodified silica gel)	0.14 1.8	4 70		Yes No (0-0.4%)	[30]
Ru(bpy)$_2$(bpy-Si) (covalently grafted)	MSU-3	84 Å apd in undoped MSU-3	0.55	190	3 / 21	No (0-<10%)	[142]
Ru(bpy)$_2$(bpy-Si) (adsorbed)			0.32	190	7.5 / 33.5		

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

Table S5. *Overview of oxygen sensing materials based on silica and ORMOSIL sol-gel matrices*

Indicator	**Matrix**	**Porosity**	**K_{SV} / kPa^{-1}**	**k_q / Pa^{-1}s^{-1}**	**Response / Recovery time / s**	**Linearity of SV plot**	**Ref**
Ru(bpy)$_3$ [a)]	TEOS sol-gel film		0.01	10	<5	No (0-<10%)	[45]
Ru(dpp)$_3$ [a)]	TEOS sol-gel film		0.07	15	<5		[46]
Ru(dpp)$_3$	TEOS sol-gel film		0.06	10	<5		[47]
PtOEP [a)]	TEOS sol-gel film		0.07	1	5 / 10	No	[49]
	TEOS sol-gel monolith		0.38	4	1-9 min	Yes	[48]
Al-ferron	TMOS/MTMOS 1:1		0.17	0.4	5s	No (0-<10%)	[143]
Ru(dpp)$_3$ [a)]	TEOS sol-gel		0.07	10			
	MTEOS/TEOS 1:1		0.13	30			
	MTEOS/TEOS 2:1		0.11	20			
	MTEOS/TEOS 3:1		0.08	20	<1		[50]
	MTEOS		0.06	10			
	ETEOS/TEOS 1:1		0.11	20			
	ETEOS		0.07	10			
Ru(dpp)$_3$ in bulk xerogel (0.02-0.1 mm, prepared by casting)	TEOS		0.02	5		Yes	
	TEOS/MTMS 9/1		0.04	8			
	TEOS/MTMS 8/2		0.04	8			
	TEOS/MTMS 7/3		0.07	14			
	TEOS/MTMS 6/4		0.09	17			
	TEOS/MTMS 5/5		0.11	19			
	TEOS/MTMS 4/6		0.13	21			
	TEOS/MTMS 3/7		0.20	32			
	TEOS/MTMS 2/8		0.19	29		No	[51]
	TEOS/MTMS 1/9		0.22	32			
	MTMS		0.27	38			
Ru(dpp)$_3$ in spin-coated thin films (<200 nm thick)	TEOS	19.1%	0.20	46			
	TEOS/MTMS 9/1		0.23	50			
	TEOS/MTMS 8/2		0.24	48			
	TEOS/MTMS 7/3		0.11	22			
	TEOS/MTMS 6/4		0.09	17			
	TEOS/MTMS 5/5	9.2%	0.11	19			

	TEOS/MTMS 4/6		0.17	27			
	TEOS/MTMS 3/7		0.13	21			
	TEOS/MTMS 2/8		0.08	12			
	TEOS/MTMS 1/9		0.05	7			
	MTMS	3.4%	0.03	5			
PtOEP	PS		0.18	2	3	No (0-10%)	[144]
$Ru(dpp)_3$			0.01	2	3		
PtOEP	Phenyl-triMOS/ trimethylmethoxysilane (18:1)		0.45	5	0.25		
$Ru(dpp)_3$			0.02	5	0.25		
$Ru(bpy)_2$(bpy-Si) [a)]	MTEOS		0.005	5	<30	Yes[b)]	[145]
Erythrosine B	Aminopropyl-triEOS/MTMOS/TMOS (32/40/28)		116	420	5-7	No (0-<5%)	[146]
	MTMOS/TMOS (60/40)		70	250			
Erythrosine B	TMOS sol gel (6·6·12 mm)		3	11	<1	No (0-<10%)	[147]
Erythrosine B	TMOS sol gel (6·6·12 mm)		650	2300	<1	No (0-<5%)	[148]
$Ru(dpp)_3$	TEOS PEBBLEs (100-600nm)		0.11	20		Yes	[34]
$Ru(dpp)_3$	TEOS	4.2%	0.01	3	0.106		[12]
	(H_2O:precursor ratio R=2)	5.5%	0.04	8	0.078		
		9.5%	0.06	13	0.04		
	TEOS	4.5%	0.04	7	0.539		
	R=4	5.7%	0.05	10	0.462		
	MTEOS (R=2)	6.4%	0.03	7	0.0049		
	MTEOS (R=4)	4.0%	0.03	5	0.0049		
$Ru(dpp)_3$	TEOS sol-gel		1.0	370	<5	No (0-<5%)	[53]
	Octyl-triEOS/TEOS (2/8)		0.08	10		Yes	
	Octyl-triEOS/TEOS (4/6)		0.11	20			
	Octyl-triEOS/TEOS (5/5)		0.12	20			
	Octyl-triEOS/TEOS (6/4)		0.15	30			
$Ru(dpp)_3$	Propyl-triMOS/TFP-triMOS (1:2)		0.34	50		Yes[b)]	[61]
$Ru(dpp)_3$	TFP-triMOS/TMOS (10:1)		0.15	30		Yes[b)]	[62]

	TFP-triMOS/Propyl-triMOS (1:1)		0.34	60			
	PFPh-triMOS/PhE-triMOS (1:2)		0.04	6			
PtTFPP [a)] PtOEP [a)]	Octyl-triEOS/TEOS (3.5:96.5)		0.21 0.46	3 5	0.6 / 5 0.7 / 14	Yes	
PtTFPP [a)] PtOEP [a)]	TFP-triMOS/Propyl-triTMOS (2:1)		0.66 0.84	8 8	3.7 / 5.3 3.7 / 5.9	Yes[b)]	[63]
$Ru(dpp)_3$	Methyl-triMOS/TMOS (1:1)	$D \sim 2.5 \cdot 10^{-7}\ cm^2s^{-1}$	0.02	4			
	Ethyl-triMOS/TMOS (1:1)	$D \sim 5 \cdot 10^{-7}\ cm^2s^{-1}$	0.03	7			
	Propyl-triMOS/TMOS (1:1)	$D \sim 9 \cdot 10^{-7}\ cm^2s^{-1}$	0.08	15			
	Butyl-triMOS/TMOS (1:1)	$D \sim 13 \cdot 10^{-7}\ cm^2s^{-1}$	0.10	20			
	Hexyl-triMOS/TMOS (1:1)	$D \sim 16 \cdot 10^{-7}\ cm^2s^{-1}$	0.11	23		Yes	[52]
	Octyl-triMOS/TMOS (1:1)	$D \sim 20 \cdot 10^{-7}\ cm^2s^{-1}$	0.11	22			
	Decyl-triEOS/TEOS (1:1)	$D \sim 16 \cdot 10^{-7}\ cm^2s^{-1}$	0.09	19			
	Dodecyl-triEOS/TEOS (1:1)	$D \sim 8 \cdot 10^{-7}\ cm^2s^{-1}$	0.05	10			
$Ru(dpp)_3$	MTEOS	$D = 0.99 \cdot 10^{-7}\ cm^2s^{-1}$	0.06	10	0.432		
	ETEOS	$D = 6.2 \cdot 10^{-7}\ cm^2s^{-1}$	0.07	15	0.232	No (0-<30%)	[59]
	Propyl-triEOS	$D = 6.7 \cdot 10^{-7}\ cm^2s^{-1}$	0.11	20	0.223		

	Phenyl-triEOS	D= 0.003 $\cdot 10^{-7}$ cm^2s^{-1}	0.02	4	2.687		
PtTFPP PtOEP	MTEOS		0.27 0.48	3 4	15 / 60	Yes	[149]
$Ru(dpp)_3$	Phenyl-triEOS Methyl-triEOS Ethyl-triEOS Propyl-triEOS Phenyl-triEOS/TFP-triMOS (1:1) Methyl-triEOS/TFP-triMOS (1:1) Ethyl-triEOS/TFP-triMOS (1:1) Propyl-triTEOS/TFP-triMOS (1:1)		0.02 0.04 0.05 0.09 0.08 0.15 0.20 0.21	5 10 10 20 20 35 50 50		No (linear <5%; above very small deviation from linearity)	[60]
PtTFPP	Dye in TEOS core/shell NPs and co-immobilized with dyed NPs in Octyl-triEOS/TEOS Dye and undyed TEOS NPs co-immobilized in Octyl-triEOS/TEOS Dye in TEOS NP core, Dyed NPs immobilized in Octyl-triEOS/TEOS	Silica NPs: 0.69 m^2g^{-1} 154 Å apd	5.1 1.7 0.37	60 20 5	1.3 / 18.6 6.8 / 41.4	No (0-<20%)	[150]
PtTFPP	Propyl-triMOS/TEOS/octyl-triEOS (1:3.6:1.4) TFP-triMOS/TEOS/octyl-triEOS (0.9:3.6:1.4)		1.4 0.92	20 10	3 / 23 2 / 68	Yes	[64]
$Ru(dpp)_3$	TEOS/cellulose acetate/ethylene glycol (4:1:1)		0.03	6		Yes	[151]
PdTCPP [a)]	TEOS/Octyl-triEOS (18:7)		1.5	2	2 / 43	Yes[b)]	[152]
PtTFPP	PS-co-PFS Phenyl-triMOS/TEOS in silicone E4		0.10 6.5	2 120		No (0-<5%)	[19]

PdTFPP	PS-co-PFS		1.1	1			
	Phenyl-triMOS/TEOS in silicone E4		96	120			

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

Table S6. *Overview of oxygen sensing materials based on electrospun nanofibers*

Indicator	Matrix	Dimensions	K_{SV} / kPa^{-1}	k_q / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
[Cu(POP)phencarz]BF_4	PS fibers PS film dip coated	Ø = 500-700 nm	0.15 0.07	1 7	7 / 14	Yes	[72]
[Cu(POP)(ECl-phen)]BF_4	PS fibers	Ø = 600 nm	0.09	1	10 / 20	Yes	[73]
[Eu$(TTA)_3$(phencarz)]	PS fibers	Ø = 400-500 nm	0.1	0.2	5 / 8	No	[74]
Eu$(TTA)_3$phen	PS fibers	Ø = 350 nm	0.02	0.1	9 / 20	Yes	[75]
PtTFPP	PS film PS fibers	30 µm thick 620 nm broad, 100 nm thick	0.09	1	2.2 / 4 32 ms	No (0-<10%)	[76,77]
Ir(2-phenylbenzo[d]thiazole)$_2$(acac) Ir(2-phenylbenzo[d]thiazole)$_2$(acac-F_3) Ir(2-phenylbenzo[d]thiazole)$_2$(acac-F_6)	PS fibers	Ø = 1.5 µm	0.05 0.08 0.12	40 15 15	14 / 27 8 / 17 9 / 23	Yes	[78]
Ru$(dpp)_3$ a)	TEOS/octyl-triEOS fiber	Ø = 900 nm	0.02	5	0.1	Yes b)	[85]
Ru$(dpp)_3$ a)	PCL fibers PES fibers PES-PCL fibers PCL film	Ø = 530 nm Ø = 7.01 µm Ø = 720 nm Ø = 960 nm	0.008 0.007 0.007 0.003	2 1 1 1 -	0.9 / 1.9 1.8 / 2.3 2.2 / 2.4 2.9 / 3.3 150 / 400	Yes	[86]
[Ru$(dpp)_3$]Cl_2 [Ru$(dpp)_3$]Ph_4B	PDMS core – PCL shell fibers	Ø = 512 nm Ø = 401 nm	0.02 0.03	3 5	0.36 / 0 72 0.28 / 0.51	Yes	[87]

PtOEP		Ø = 570 nm	0.23	3	0.49 / 0.70		
$Ru(dpp)_3$ a) + LiY_4:Yb,Tm UCNPs	PSU core – PCL shell fibers		0.00 3	1	0.2 / 0.4	Yes	[88]
PtTPA PdTPP PtTPP PdTPA	pTMSP fibers AgNPs@pTMS P fibers	Ø = 283- 727 nm Ø = 141- 467 nm	0.7 6 0.4 3	10 10 5 7	4.5	No (0-5%) No (0-40%)	[153]
PtTPPMA a)	pMMA p(PFPA-co- OCFPM) p(MMA-co- PFPA-co- OCFPM) p(S-co-PFPA- co-OCFPM)	Nanofibers Spin coated films Nanofibers Spin coated films Nanofibers Spin coated films Nanofibers Spin coated films	0.01 0.01 0.04 0.01 0.14 0.01 0.07 0.01	0.1 0.2 0.5 0.1 1.7 0.1 0.8 0.1	9.15 / 15 14.40 / 41.71 6.70 / 146.9 10.05 / 61.87 4.42 / 141.27 10.30 / 74.47 10.40 / 112.96 16.21 / 161.95	Yes No Yes No Yes No Yes No	[89]
PtOEP a)	1% AgNWs in PMMA film 1% AgNWs in PMMA fibers 3% AgNWs in PMMA fibers	AgNWs Ø=50 nm, length=100 µm ; PMMA fibers Ø~3 µm	0.09 0.32 0.61	0.1 0.3 0.6	- 3 / 12.6 1.8 / 14.4	No (0-10%) No	[154]
$Ru(bpy)_3$	EC fibers containing Fe_2O_3 EC fibers containing Fe_2O_3@Ag	Film thickness ~ 5.12 µm, both Fe_2O_3 and Fe_2O_3@Ag NPs Ø~60 nm	0.02 4 0.02 4	13 0 10 0	3-20	Yes	[155]

	EC film containing Fe_2O_3		0.017	90				
	EC film containing Fe_2O_3@Ag		0.019	80				
$Ru(dpp)_3$ a)	MTEOS fibers containing SiCDs	BET surface = 15.22 m^2g^{-1} 52.4 Å “apd“ of fiber mat Fiber Ø = 0.5-1 µm	0.02	5			Yes	[156]

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

Table S7. *Overview of oxygen sensitive MOFs*

MOF	Matrix / Support	Porosity	K_{SV} / kPa^{-1}	kq / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
$[Zn_4(\mu_4\text{-}O)(Ir(4\text{-}cppy)_3)_2]\cdot 6DMF\cdot H_2O$		N_2 BET: 764 m^2g^{-1}, CO_2 BET 958 m^2g^{-1}, apd 4.5 & 5.8 Å	0.01	7		Yes	[98]
$Ir(ppy)_2$(5-dcppy)@UiO-67 $Ir(ppy)_2$(5-dcbpy)@UiO-67 $Ru(bpy)_2$(5-dcbpy)@UiO-67		N_2 BET: 2568 m^2g^{-1} N_2 BET: 2292 m^2g^{-1} N_2 BET: 1277 m^2g^{-1}	0.78 0.88 2.25	390 440 2250		No (0-<5%)	[99]
$[Zn(Ir(ppy)_2(4\text{-}dcbpy)PF_6)_2]\cdot 3DMF\ 5H_2O$ a) $[Cd(Ir(ppy)_2(4\text{-}dcbpy)PF_6)_2(H_2O)_2]\cdot 3DMF\ 6H_2O$ a) $[Co(Ir(ppy)_2(4\text{-}dcbpy)PF_6)_2(H_2O)_2]\cdot 2DMF\cdot 8H_2O$ a) $[Ni(Ir(ppy)_2(4\text{-}dcbpy)PF_6)_2(H_2O)_2]\cdot 3DMF\cdot 6H_2O$ a)		Channels: 8.9 Å · 8.8 Å Channels: 9.3 Å · 9.3 Å Channels: 9.1 Å · 9.1 Å Channels: 9.1 Å · 9.1 Å	0.01 0.03 0.01 0.01	4 15 10 5	120 / 110 70 / 30 200 / 90 240 / 40	Yes	[100]
MAF-X11		N_2 BET: 1495 m^2g^{-1}, O_2 BET: 2091 m^2g^{-1}	0.27	19200		No (0-<5%)	[104]
$Ru(iphen)_3$ linker doped into MAF-34		O_2 uptake: 3.2 cm^3g^{-1}	0.25	230		No (0-<5%)	[101]
MIL-100(In)⊃Tb^{3+} CPM-5⊃TB^{3+}	on ITO glass	Pore free inner diameter: 20 & 26 Å pore size: 4.89 Å	0.07 0.01	0.08 0.01	6 / 53 90 / 60	Yes b)	[96]
MAF-2	-	N_2 BET: 539 m^2g^{-1}	3.56	30	<1	Yes	[113]

	silicone rubber		2.64	20		No (0-10%)	
Pyrene @ MAF-4	on silica silicone rubber	Cavities: Ø~11.4 Å, apertures ~ 3.3 Å	0.18 0.07	3230 1320		Yes	[105]
$Pb_4([Ir(ppy)_2(4\text{-}dcbpy)]PF_6)_4I_4(DMF)_2]\cdot 10H_2O$			0.05	350	50 / 24	Yes	[102]
C480 @ $Pb_4([Ir(ppy)_2(4\text{-}dcbpy)]PF_6)_4I_4(DMF)_2]\cdot 10H_2O$	PDMS		0.04	260			
AlQ_3 @ MAF-X10		N_2 BET: >2000 m^2g^{-1}, aperture size: 5.8·6.6 Å, cavity size: 9.4·9.9 Å	0.08	2030		Yes	[106]
MAF-X10			0.05	15100			
MCF-53 ($Tb_{0.966}/Eu_{0.034}$) (Eu^{3+} emission)		Void ratio 15.5%, Channel size 3.8 Å	0.10	0.3		No (0-10%)	[103]
MCF-53 ($Tb_{0.786}/Eu_{0.214}$) (Eu^{3+} emission)			0.09	0.4			
MCF-53 ($Tb_{0.663}/Eu_{0.337}$) (Eu^{3+} emission)			0.06	0.3			
MCF-53 (Eu) (Eu^{3+} emission)			0.01	0.2			
MCF-53 (Tb) (ligand emission)			0.03	21700			
MCF-53 ($Tb_{0.966}/Eu_{0.034}$) (ligand emission)			0.009	8020			
MCF-53 ($Tb_{0.786}/Eu_{0.214}$) (ligand emission)			0.01	10500			

MCF-53 ($Tb_{0.663}$/$Eu_{0.337}$) (ligand emission)			0.01	18300			
MCF-53 (Eu) (ligand emission)			0.002	3300			
Gd[(Pyr)$_4$cyclen] @ ZIF-8		N_2 BET: 806.12 m^2g^{-1}	4.64	130		No (0-2%)	[107]
[Ag_{12}(StBu)$_8$(CF3COO)$_4$(bpy-NH_2)$_4$]$_n$		Void space 17.5%	2250	720	0.3	No (0-<1%)	[110]
PtCN(L) @ ZIF-8 a)		BET 1378 m^2g^{-1}, total pore vol. 0.74 cm^3g^{-1}, µpore vol. 0.4 cm^3g^{-1}	0.21	10			[108]
EuNDC		Pore sizes: 8 Å & 4 Å, N_2 BET: 417 m^2g^{-1}	0.13	0.1	10 / 70		[111]
EuNDC	PDMS	N_2 BET: 6.05 m^2g^{-1}	0.04	0.03			[111]
SUMOF-6-EU@O-PP	PDMS	N_2 BET: 524 m^2g^{-1}	0.07	0.06	10 / 60	Yes b)	[112]
PCN-224			0.25	37300	6 / 7	No (0-20%)	[97]
	Glass fibers		0.15	22400		No (0-<10%)	
	PAN fibers		0.19	28400	<1	No (0-20%)	
	Silica gel		0.29	43300		No (0-<10%)	
H_2TMCPP	pTMSP		0.07	7200			
	Silica gl		0.19	19000			
Pt-PCN-224			73	3900		No (0-<0.05%)	
Pd-PCN-224			2610	6700		No (0-<0.01%)	
Ir(ppy)$_2$(BisPh$_2$PPh)@ bio-MOF-1		N_2 BET: 561 m^2g^{-1},	0.22	50	9 / 22	Yes	[109]

$Ir(ppy)_2(PPh_3)$@bio-MOF-1		pore size 17.1 Å N_2 BET: 672m^2g^{-1}, pore size 19.5 Å	0.20	80			

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

Table S8. *Overview of alumina-based oxygen sensing materials*

Indicator	Matrix	Porosity	K_{SV} / kPa^{-1}	k_q / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
H$_2$TMCUPP [a)]	Anodized alumina plate	apd = 150 – 200 Å	0.23	23000	9.4 / 15.5	No (0-<20%)	[124]
H$_2$MCUTPP [a)]			0.14	14900	12.5 / 17.0		
H$_2$CTPP [a)]			0.14	14100	9.6 / 20.8		
PtTMCUPP [a)]			17	210	5.0 / 667	No (0-<5%)	
PtMCUTPP [a)]			10	130	8.9 / 590		
PtCTPP [a)]			16	200	4.6 / 580		
Ru(dpp)$_3$	Anodized alumina	apd = 200-1000 Å Thickness 6.1 µm	0.29	220	$2 \cdot 10^{-5}$	No (0-<10%)	[123]
H$_2$TCPP			0.08	12400	$1 \cdot 10^{-5}$		
PtTCPP			7.17	160			
PBA			0.22	4300	$<1 \cdot 10^{-3}$		
PdPC$_{10}$COOH [a)]	Alumina TLC plate		3.0	3	36 / 148	No (0-<10%)	[126 – 128]
H$_2$TCPP [a)]			0.35	35300	3.4 / 15		
PtTCPP [a)]			1.6	20	8.6 / 50		
PdTCPP [a)]			4.5	5	36 / 148		
Tb(acac)$_3$phen			0.14	0.6	7.3 / 70		
Ru(dC$_8$pp)$_3$ [a)]	AlOOH in PVA	Total pore vol. 20 mL m^{-2}, apd 190 Å	0.71	140	<1 / <2	No (0-<20%)	[129]
[Ir(ppy)$_2$(Me$_4$dabpy)]ClO$_3$ [a)]			1.0	510			
[Ir(ppy)$_2$(SCN)$_2$]N(C$_4$H$_9$)$_4$ [a)]			0.35	180			
[Ir(ppy)$_2$(OCN)$_2$]N(C$_4$H$_9$)$_4$ [a)]			0.87	440			
Ru(dC$_8$pp)$_3$ [a)]	PS		0.016	3			
[Ir(ppy)$_2$(Me$_4$dabpy)]ClO$_3$ [a)]			0.012	6			
[Ir(ppy)$_2$(SCN)$_2$]N(C$_4$H$_9$)$_4$ [a)]			0.0030	2			
[Ir(ppy)$_2$(OCN)$_2$]N(C$_4$H$_9$)$_4$ [a)]			0.0070	4			
[Ir(F$_2$ppy)$_2$(Me$_4$dabpy)]PF$_6$	PS		3.6	1790	<4	No (0-<10%)	[130]
[Ir(ppy)$_2$(dpp)]PF$_6$			1.6	820			
[Ir(F$_2$ppy)$_2$(dpp)]PF$_6$			0.72	360			
[Ir(ppy)$_2$(Brbpy)]PF$_6$			3.1	1600			
[Ir(F$_2$ppy)$_2$(Me$_4$dabpy)]PF$_6$			0.87	440			

$[Ir(ppy)_2(dpp)]PF_6$	PS		2.0	980			
$[Ir(F_2ppy)_2(dpp)]PF_6$	(8.5 wt.%		0.34	170			
$[Ir(ppy)_2(Brbpy)]PF_6$	plasticizer)		1.0	520			
$[Ir(F_2ppy)_2(Me_4dabpy)]PF_6$	PS		0.53	270			
$[Ir(ppy)_2(dpp)]PF_6$	(17.5 wt.%		0.96	480			
$[Ir(F_2ppy)_2(dpp)]PF_6$	plasticizer)		0.28	140			
$[Ir(ppy)_2(Brbpy)]PF_6$			1.1	570			
$[Ir(F_2ppy)_2(Me_4dabpy)]PF_6$	AlOOH		12	6200			
$[Ir(ppy)_2(dpp)]PF_6$			28	14200			
$[Ir(F_2ppy)_2(dpp)]PF_6$			2.2	1100			
$[Ir(ppy)_2(Brbpy)]PF_6$			5.6	2800			

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

Table S9. *Overview of miscellaneous (porous) oxygen sensitive materials*

Indicator	Matrix	Porosity	K_{SV} / kPa^{-1}	k_q / $Pa^{-1}s^{-1}$	Response / Recovery time / s	Linearity of SV plot	Ref
$Ir(ppy)_3$ a)	Amberlite XAD-4	750 m^2g^{-1}, apd 100 Å	0.34	170		No (0-<10%)	[117]
PtTFPP-MA a) Covalently grafted to matrix	PS-PVP	apd 4000 Å, "high" pore density apd 4000 Å, "low" pore density Non-porous	0.6 0.4 0.2	0.8 0.5 0.3	2.5 / 3 3.5 / 5.5 4 / 6.5	Yes	[118]
PtBP	PP fibers hollow, 40 µm diameter PE fibers solid, 40 µm diameter		0.39 0.53	10 13	60 30	No (0-<10%)	[120]
PtOEP a) PdOEP a)	PS PDMS pTMSP PS PDMS pTMSP		0.13 0.20 6.5 0.84 0.89 17	1 2 70 0.8 0.9 20	35 / 100 10 / 82 3.6 / 73.2 10.6 / 158.8 9 / 200.2 3.2 / 250	Yes No (0-<20% No (0-<6%)	[157,158]
PtTFPP	pTMSP				<0.03	No	[159]
$Ru(bpy)_3$	TiO_2 sol-gl	Average porosity 60%, thickness 9 µm	1.9	4600	4 / 7	No (0-<10%)	[160]
PtTPP a) linked to 3-(trimethoxysilyl)propyl methacrylate and	PDMS micropillar arrays	Micropillar height: 60 µm, diameter:	1.0	10	25 / 97	Yes	[119]

covalently grafted to matrix	PDMS film	50 µm, distance: 100 µm	0.16	2			
$[Ru(phen)_3]$tfpb $[Ru(5,6$-$Me_2phen)]$tfpb $[Ru(phen)_3](PF_6)_2$	Pure dye crystal	Void fraction 0.055 Void fraction 0.01	0.024 0.0079 0.033	40 10 70		No	[161–163]
$Ru(bpy)_3$ [a)]	Zeolite Y in E4 silicone (Encapsulated in zeolite cavities) Zeolite Y in E4 silicone (adsorbed on zeolite surface) Silica (Partisil 5) in E4 silicone	Zeolite Y: Al/Si ratio = 11, dealuminated with EDTA Main channel diameter: 7.4 Å, supercage diameter: 13 Å 350 m^2g^{-1}, 85 Å apd	0.024 0.0069 0.032	20 7 30	6-10	No (0-<20%)	[164]

a) τ_0 not given for the indicator in this material but estimated based on other literature

b) first calibration point at 20% O_2

a) Estimates for τ_0 when not given in the paper

$Ru(bpy)_3$ and derivatives thereof	1 µs
$Ru(phen)_3$ and derivatives thereof	2.5 µs
$Ru(dpp)_3$ and derivatives thereof	5 µs
PtOEP and derivatives thereof	100 µs
PtTPP and derivatives thereof	80 µs
Pd porphyrins	1 ms

$Ir(ppy)_3$ and derivatives thereof	2 µs

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