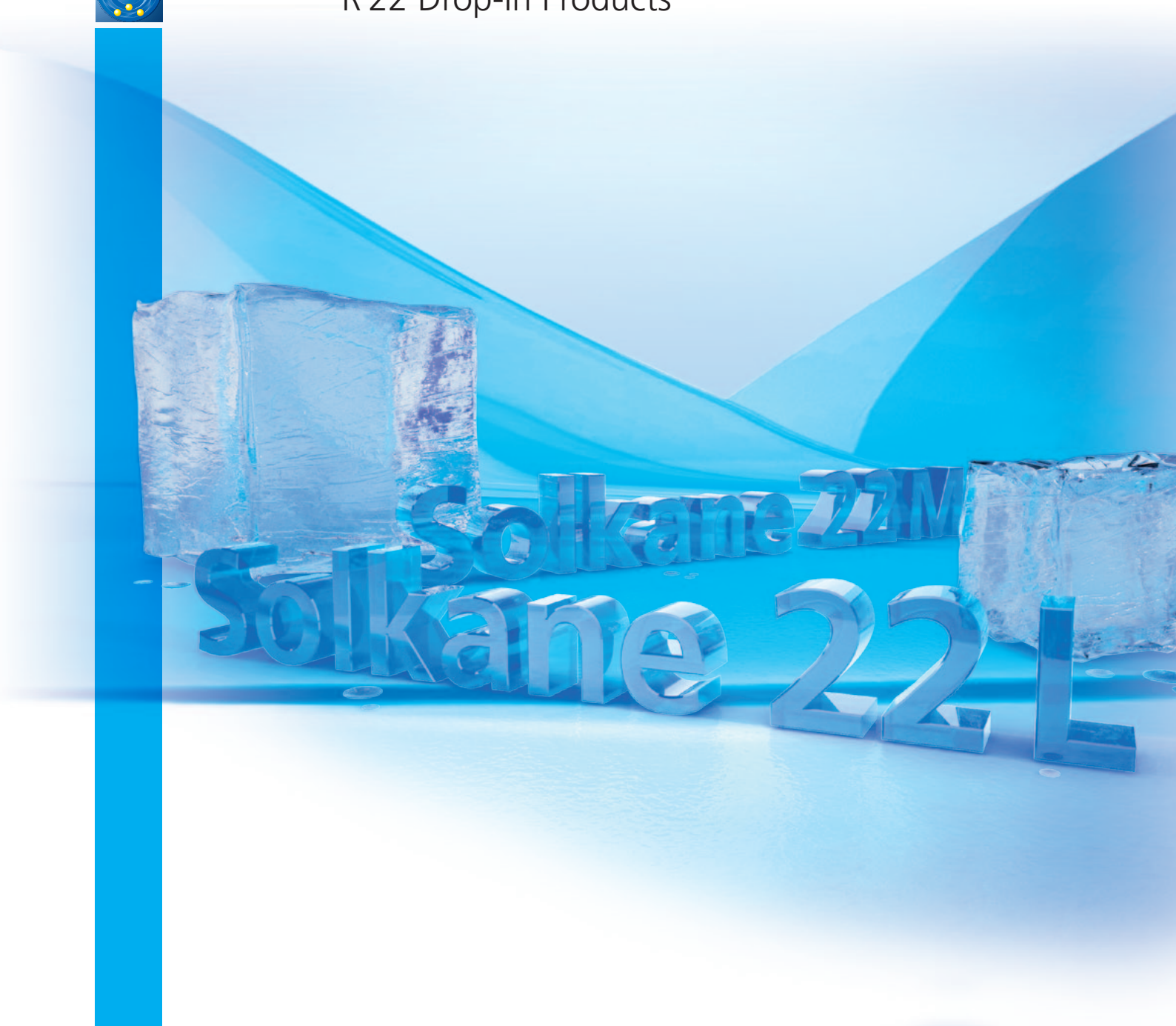
Solkane® 22 M / Solkane® 22 L

R 22 Drop-In Products



Solvay
Fluor

SOLVAY

Product Description

As of 01.01.2010 the use of virgin R 22 as refrigerant is banned in the European Union due to EU legislation 2037/2000.

Solvay Fluor now offers a family of carefully selected Solkane® refrigerants that provide for easy and cost-efficient ways to comply with this regulation until the end of your systems lifetime.

The product family contains one specific "ODP 0" HFC solution for each application field.

Solkane® 22 M is the product of choice for airconditioning systems operating at evaporation temperatures above 0 °C.

Solkane® 22 L is designed for medium and low temperature applications as they are found in supermarket or commercial refrigeration systems.

Applications

Solkane® 22 M

Solkane® 22 M is a "Drop-in" solution for easy replacement of R 22 in existing a/c systems. The product is applicable for residential and commercial direct expansion units and is extensively tested. The product is compatible with practically all commonly used lubricants such as mineral oils, alkylbenzene oils and polyolester oils.

Solkane® 22 L

Solkane® 22 L is a "Drop-in" solution for easy replacement of R 22 in existing refrigeration systems. The product can be used in both medium and low temperature applications. Tests have shown that Solkane® 22 L outperforms other available alternatives and R 22 with respect to capacity especially at high condensation temperatures or heavy duty operating conditions. It also delivers very favourable efficiencies. Suitable evaporation temperatures range from – 30 °C to above zero. Solkane® 22 L is a very versatile product and it is compatible with practically all commonly used lubricants such as mineral oils, alkylbenzene oils and polyolester oils. Typical applications are supermarket display cases, small cold stores, ice machines, etc.

Physical Properties

	Unit	Solkane® 22 M	Solkane® 22 L
Chemical Formula		$CHF_2CF_3/CH_2FCF_3/C_4H_{10}$	$CHF_2CF_3/CH_2FCF_3/C_4H_{10}$
Molecular Weight	[kg/kmol]	106.8	113.1
Boiling Point at 1.01325 bar	[°C]	–39.1	–44.9
Critical Temperature	[°C]	87.1	75.2
Critical Pressure	[bar]	40.4	38.3
Critical Density	[kg/m³]	520.6	542.9
Critical Volume	[m³/kg]	1.92 E-03	1.84 E-03
Density Liquid [1)]	[kg/m³]	1151.8	1154.3
Density Vapor [1)]	[kg/m³]	47.6	67.7
Heat of Vaporisation [1)]	[kJ/kg]	149.0	125.3
Specific Heat Capacity Liquid [1)]	[kJ/(kg*K)]	1.457	1.449
Specific Heat Capacity Vapor [1)]	[kJ/(kg*K)]	1.062	1.174

[1)] saturated, t = 25 °C

Packaging

Loan steel container (approx. 800 kg) 

ISO-tank container (approx. 16,900 kg) 

Returnable steel cylinders: upon request

General Advice on System Conversion from R 22 to Solkane® 22 M/L

Solkane® 22 M/L are designed for an easy replacement of R 22. They combine compatibility to most R 22 systems with good capacity and efficiency characteristics.

Nevertheless some changes on the system itself could be necessary. Following system modifications are recommended when using Solkane® 22 M/L:

- Replacement the filter dryer (introduce an HFC model e.g. for R 404 A)
- Replace the gaskets which were in contact with R 22 e.g. o-rings, solenoid valves etc.
- Adjust the expansion device
- Check if system components are able to accommodate the slightly higher system pressure of Solkane® 22 L (see wet vapour table)
- Labeling of the converted system acc. EU842/2006

Oil Management

Solkane® 22 M/L is compatible with most of the standard oils used in the existing R 22 systems. The correct choice of oil is always a matter of further influencing factors e.g. compressor type, system design, compatibility vs. non metallic components and oil return capability. R 22 systems with a difficult oil return behaviour e.g. flooded evaporators or widely branched systems should be converted to a suitable polyolester oil during the conversion to Solkane® 22 M/L.

Compatibility to Elastomers and Plastics

R 22 has different solvent characteristics than Solkane® 22 M/L which might be critical to the non metal components. Furthermore the tightness of the system is often related to the age of the gaskets and sealings. The simple decompression of the R 22 containing gasket materials can already lead to a destruction of the gasket itself. Therefore a replacement of elastomer gaskets e.g. in solenoid valves, o-rings etc. is recommended. An exchange of all critical gaskets and sealings is mandatory.

Compatibility elastomers vs. Solkane® 22 M/L

	Neoprene	HNBR	NBR	EPDM
Polyolester oil	+	o	+	+
Mineral oil	+	–	+	–

Compatibility plastics vs. Solkane® 22 M/L

	Polyester	Nylon	Epoxy
Polyolester oil	o	+	+
Mineral oil	o	+	+

Compatibility criteria: + good / o moderate / – poor

Performance Characteristics of R 22 vs. Solkane® 22 L

Theoretical capacity comparisons (To: –30°C) suggest that Solkane® 22 L delivers ca. 20% lower refrigeration capacity than R 22. Practical measurements however show that actual delivered capacity is equal to that of R 22 – sometimes even supperior. For condensation temperatures of 45 °C and higher practical measurements show slightly higher capacities and efficiencies of Solkane® 22 L vs. R 22. Solkane® 22 L also outperforms other R 22 drop-in products with respect to capacity and efficiency. Contact our technical specialists for detailed comparisons.

Performance Characteristics of R 22 vs. Solkane® 22 M

While the trend observed with Solkane® 22 L is also true for Solkane® 22 M (the actual performance is better that thermodynamic cycle calculations), the effective capacity and efficiency for Solkane® 22 M will be lower than that for R 22. Typical deltas range between 15 and 20%. It can be observed though that the majority of installed units have excess capacity in this order of magnitude. A clear advantage is that Solkane® 22 M will reduce the compressor discharge temperature vs. R 22. Contact our technical specialists for detailed comparisons.

Thermodynamic Properties of Solkane® 22 Drop-In Products

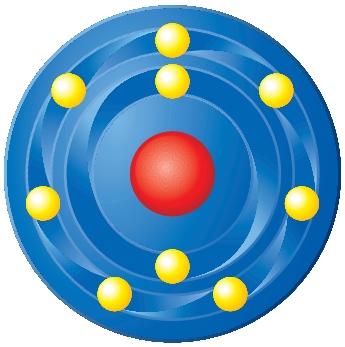
Release 1.02

Solkane® 22 M

T °C	P′ bar	P″ bar	v′ dm³/kg	v″ m³/kg	h′ kJ/kg	h″ kJ/kg	s′ kJ/kgK	s″ kJ/kgK
–60	0.34	0.24	0.692	0.671	124.2	334.4	0.688	1.688
–58	0.38	0.28	0.695	0.596	126.7	335.6	0.699	1.684
–56	0.43	0.31	0.698	0.532	129.1	336.9	0.710	1.680
–54	0.48	0.35	0.701	0.476	131.5	338.1	0.721	1.677
–52	0.53	0.40	0.704	0.426	133.9	339.4	0.732	1.674
–50	0.59	0.44	0.707	0.383	136.4	340.7	0.743	1.671
–48	0.66	0.50	0.710	0.345	138.8	341.9	0.754	1.668
–46	0.73	0.55	0.713	0.311	141.2	343.2	0.765	1.665
–44	0.80	0.62	0.716	0.281	143.7	344.4	0.776	1.663
–42	0.88	0.68	0.720	0.255	146.1	345.7	0.787	1.660
–40	0.97	0.76	0.723	0.231	148.6	346.9	0.797	1.658
–38	1.06	0.84	0.726	0.211	151.0	348.2	0.808	1.656
–36	1.17	0.92	0.730	0.192	153.5	349.4	0.819	1.653
–34	1.27	1.02	0.733	0.175	156.0	350.6	0.829	1.651
–32	1.39	1.12	0.736	0.160	158.5	351.9	0.840	1.650
–30	1.52	1.23	0.740	0.147	161.0	353.1	0.850	1.648
–28	1.65	1.34	0.743	0.135	163.5	354.3	0.861	1.646
–26	1.79	1.47	0.747	0.124	166.0	355.6	0.871	1.644
–24	1.95	1.60	0.751	0.114	168.6	356.8	0.881	1.643
–22	2.11	1.75	0.754	0.105	171.1	358.0	0.891	1.641
–20	2.28	1.90	0.758	0.097	173.7	359.2	0.901	1.640
–18	2.46	2.06	0.762	0.090	176.3	360.4	0.911	1.639
–16	2.66	2.24	0.766	0.083	178.9	361.6	0.922	1.638
–14	2.86	2.42	0.770	0.077	181.5	362.7	0.931	1.636
–12	3.08	2.62	0.774	0.071	184.1	363.9	0.941	1.635
–10	3.31	2.83	0.778	0.066	186.7	365.1	0.951	1.634
–8	3.55	3.05	0.782	0.062	189.4	366.2	0.961	1.633
–6	3.81	3.28	0.786	0.057	192.0	367.4	0.971	1.632
–4	4.08	3.53	0.791	0.053	194.7	368.5	0.981	1.632
–2	4.36	3.79	0.795	0.050	197.4	369.7	0.990	1.631
0	4.66	4.07	0.800	0.046	200.0	370.8	1.000	1.630
2	4.97	4.36	0.805	0.043	202.8	371.9	1.010	1.629
4	5.30	4.67	0.809	0.041	205.5	373.0	1.019	1.629
6	5.65	4.99	0.814	0.038	208.2	374.1	1.029	1.628
8	6.01	5.33	0.819	0.036	211.0	375.2	1.038	1.627
10	6.39	5.68	0.824	0.033	213.7	376.2	1.048	1.627
12	6.79	6.06	0.830	0.031	216.5	377.3	1.057	1.626
14	7.20	6.45	0.835	0.029	219.2	378.3	1.067	1.626
16	7.63	6.86	0.841	0.028	222.0	379.3	1.076	1.625
18	8.09	7.29	0.847	0.026	224.8	380.3	1.086	1.625
20	8.56	7.75	0.853	0.024	227.6	381.3	1.095	1.624
22	9.06	8.22	0.859	0.023	230.4	382.3	1.105	1.624
24	9.57	8.71	0.865	0.022	233.3	383.2	1.114	1.623
26	10.11	9.22	0.871	0.020	236.1	384.2	1.123	1.623
28	10.66	9.76	0.878	0.019	239.0	385.1	1.133	1.622
30	11.25	10.32	0.885	0.018	241.9	386.0	1.142	1.622
32	11.85	10.91	0.892	0.017	244.8	386.8	1.152	1.621
34	12.48	11.52	0.900	0.016	247.8	387.7	1.161	1.620
36	13.13	12.15	0.908	0.015	250.7	388.5	1.171	1.620
38	13.81	12.81	0.916	0.014	253.7	389.2	1.181	1.619
40	14.51	13.50	0.925	0.014	256.7	390.0	1.190	1.619
42	15.24	14.21	0.933	0.013	259.8	390.7	1.200	1.618
44	16.00	14.95	0.943	0.012	262.9	391.4	1.210	1.617
46	16.78	15.72	0.953	0.011	266.0	392.0	1.219	1.616
48	17.60	16.52	0.963	0.011	269.2	392.6	1.229	1.615
50	18.44	17.35	0.974	0.010	272.4	393.1	1.239	1.614
52	19.31	18.22	0.985	0.010	275.7	393.6	1.249	1.613
54	20.22	19.11	0.998	0.009	279.0	394.1	1.259	1.612
56	21.15	20.04	1.011	0.008	282.4	394.4	1.270	1.611
58	22.12	21.00	1.025	0.008	285.9	394.7	1.280	1.609
60	23.12	22.00	1.040	0.008	289.4	395.0	1.290	1.607
62	24.15	23.04	1.056	0.007	293.0	395.1	1.301	1.606
64	25.22	24.11	1.074	0.007	296.7	395.1	1.312	1.603
66	26.32	25.22	1.093	0.006	300.5	395.0	1.322	1.601
68	27.47	26.38	1.114	0.006	304.4	394.8	1.333	1.598
70	28.64	27.58	1.137	0.005	308.4	394.4	1.344	1.595
72	29.86	28.82	1.164	0.005	312.5	393.8	1.356	1.592
74	31.12	30.11	1.194	0.005	316.7	393.0	1.367	1.587
76	32.42	31.46	1.228	0.004	321.1	391.9	1.379	1.582
78	33.76	32.85	1.269	0.004	325.6	390.4	1.390	1.577
80	35.15	34.31	1.319	0.004	330.2	388.5	1.402	1.569
82	36.58	35.84	1.384	0.003	335.1	386.0	1.414	1.561
84	38.02	37.49	1.535	0.00	344.9	378.6	1.444	1.539

Solkane® 22 L

p′ bar	p″ bar	v′ dm³/kg	v″ m³/kg	h′ kJ/kg	h″ kJ/kg	s′ kJ/kgK	s″ kJ/kgK
0.46	0.37	0.675	0.410	127.1	314.7	0.700	1.591
0.52	0.42	0.678	0.367	129.4	315.9	0.711	1.588
0.58	0.47	0.681	0.329	131.7	317.0	0.721	1.585
0.64	0.53	0.684	0.296	134.0	318.2	0.732	1.582
0.71	0.59	0.687	0.266	136.3	319.3	0.742	1.579
0.79	0.66	0.691	0.240	138.6	320.5	0.753	1.577
0.87	0.73	0.694	0.217	141.0	321.6	0.763	1.574
0.96	0.81	0.697	0.197	143.3	322.8	0.774	1.572
1.06	0.90	0.700	0.179	145.6	323.9	0.784	1.570
1.16	0.99	0.704	0.163	147.9	325.0	0.794	1.568
1.28	1.09	0.707	0.149	150.3	326.2	0.805	1.566
1.40	1.20	0.710	0.136	152.6	327.3	0.815	1.564
1.53	1.32	0.714	0.124	155.0	328.4	0.825	1.562
1.66	1.44	0.717	0.114	157.4	329.5	0.835	1.561
1.81	1.58	0.721	0.105	159.8	330.6	0.845	1.559
1.97	1.72	0.725	0.096	162.2	331.7	0.855	1.558
2.14	1.88	0.728	0.089	164.7	332.8	0.865	1.556
2.32	2.04	0.732	0.082	167.1	333.9	0.875	1.555
2.51	2.22	0.736	0.075	169.6	334.9	0.885	1.554
2.71	2.41	0.740	0.070	172.0	336.0	0.895	1.552
2.93	2.61	0.744	0.065	174.5	337.1	0.905	1.551
3.15	2.82	0.748	0.060	177.0	338.1	0.915	1.550
3.39	3.05	0.752	0.056	179.6	339.2	0.924	1.549
3.65	3.29	0.756	0.052	182.1	340.3	0.934	1.548
3.92	3.54	0.761	0.048	184.6	341.3	0.943	1.548
4.20	3.81	0.765	0.045	187.2	342.3	0.953	1.547
4.50	4.09	0.770	0.042	189.8	343.4	0.962	1.546
4.81	4.39	0.774	0.039	192.3	344.4	0.972	1.545
5.14	4.70	0.779	0.036	194.9	345.4	0.981	1.545
5.49	5.03	0.784	0.034	197.5	346.4	0.991	1.544
5.86	5.38	0.789	0.032	200.0	347.4	1.000	1.544
6.24	5.75	0.794	0.030	202.8	348.4	1.009	1.543
6.64	6.13	0.799	0.028	205.4	349.4	1.019	1.543
7.06	6.54	0.805	0.026	208.1	350.4	1.028	1.542
7.50	6.96	0.811	0.025	210.7	351.4	1.037	1.542
7.96	7.41	0.816	0.023	213.4	352.3	1.046	1.542
8.44	7.87	0.822	0.022	216.1	353.3	1.056	1.541
8.94	8.36	0.828	0.021	218.8	354.2	1.065	1.541
9.47	8.86	0.835	0.019	221.5	355.2	1.074	1.541
10.01	9.40	0.841	0.018	224.2	356.1	1.083	1.540
10.58	9.95	0.848	0.017	226.9	357.0	1.093	1.540
11.18	10.53	0.855	0.016	229.7	357.9	1.102	1.540
11.79	11.13	0.863	0.015	232.5	358.7	1.111	1.540
12.44	11.76	0.870	0.014	235.3	359.6	1.120	1.539
13.10	12.42	0.878	0.014	238.1	360.4	1.130	1.539
13.80	13.10	0.887	0.013	241.0	361.2	1.139	1.539
14.52	13.81	0.895	0.012	243.9	362.0	1.149	1.539
15.27	14.55	0.904	0.011	246.8	362.8	1.158	1.538
16.05	15.32	0.914	0.011	249.8	363.5	1.168	1.538
16.86	16.11	0.924	0.010	252.8	364.2	1.177	1.537
17.69	16.94	0.935	0.010	255.8	364.8	1.187	1.537
18.56	17.80	0.946	0.009	258.9	365.4	1.197	1.536
19.46	18.70	0.958	0.008	262.1	365.9	1.207	1.535
20.39	19.63	0.971	0.008	265.3	366.4	1.217	1.534
21.36	20.59	0.985	0.007	268.6	366.7	1.227	1.533
22.36	21.59	1.000	0.007	272.0	367.0	1.237	1.532
23.39	22.62	1.016	0.007	275.4	367.1	1.248	1.530
24.47	23.70	1.034	0.006	278.9	367.0	1.258	1.527
25.57	24.81	1.053	0.006	282.6	366.6	1.269	1.524
26.72	25.97	1.074	0.005	286.3	365.9	1.280	1.520
27.91	27.17	1.098	0.005	290.2	364.6	1.291	1.514
29.13	28.42	1.126	0.004	294.2	362.4	1.302	1.506
30.40	29.72	1.157	0.004	298.3	359.6	1.314	1.496
31.72	31.07	1.194	0.003	302.6	358.3	1.325	1.491
33.07	32.47	1.240	0.003	307.0	358.5	1.337	1.490
34.48	33.94	1.298	0.003	311.6	359.3	1.349	1.491



Solvay Fluor – Competence in Fluorine Chemistry. Worldwide.

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