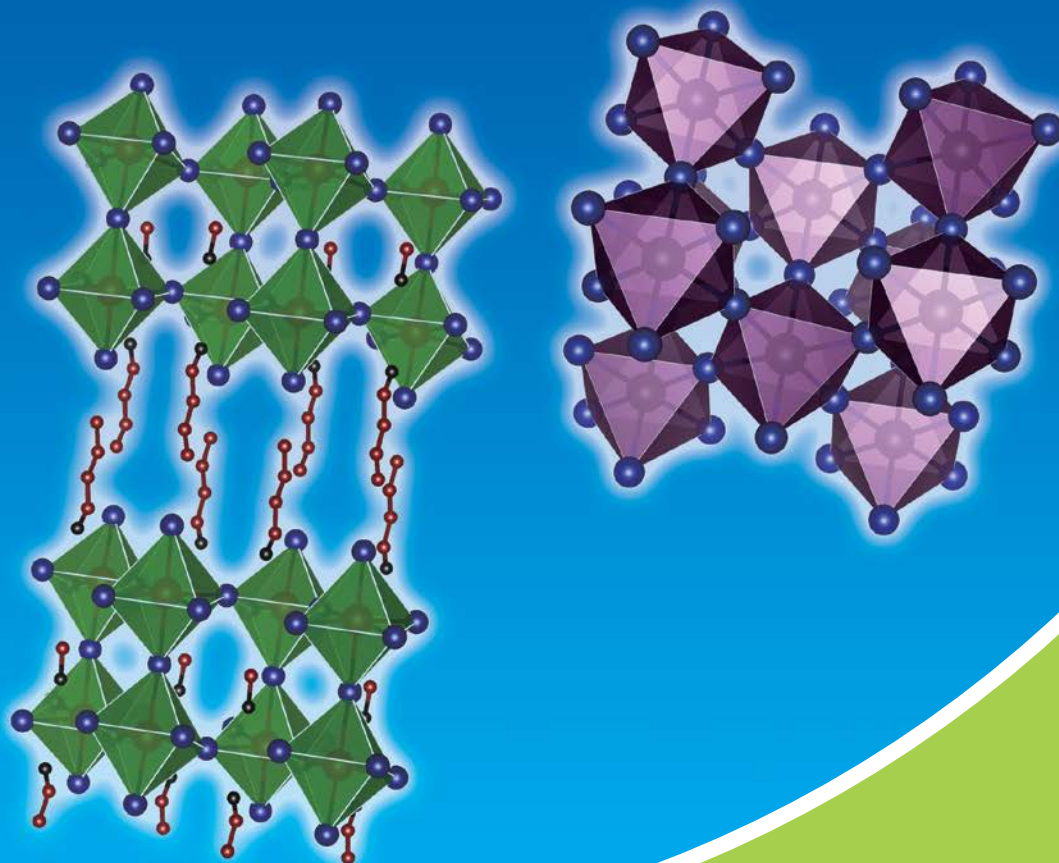


有機無機ペロブスカイト前駆体

Organic-Inorganic Perovskite Precursors



有機オニウム塩

ハロゲン化鉛

その他の鉛化合物

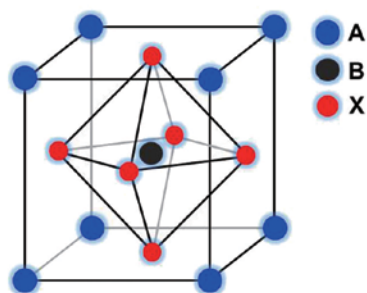
ハロゲン化セシウム

ハロゲン化ビスマス

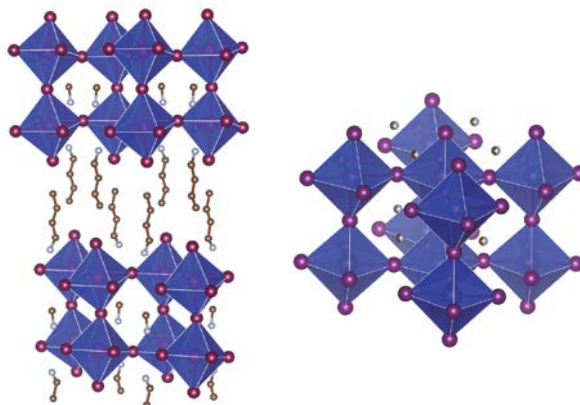
ハロゲン化スズ

有機無機ペロブスカイト前駆体

ペロブスカイトはチタン酸カルシウム (CaTiO_3) の鉱物名で、 ABX_3 (Aは2価、Bは4価の金属イオン) で表される化合物をペロブスカイト型化合物と総称しています。正方晶や斜方晶のペロブスカイトは強誘電性を示し、チタン酸バリウム (BaTiO_3) が強誘電体や圧電体としてよく知られています¹⁾。また、銅酸化物を基本単位とする酸化物高温超伝導体は、すべてペロブスカイト構造を持っています²⁾。これらのペロブスカイト型化合物は金属イオンと酸素のみで構成されており、焼結法などの物理的な手法で作成されます³⁾。焼結の際、金属イオンの種類や比率を変えたり、添加物を加えたりすることで物性が劇的に変化するのがペロブスカイト型化合物の特徴です。また、酸化物だけでなく、金属ハロゲン化物などを成分とするペロブスカイト型化合物も知られています。



ペロブスカイト型化合物におけるAサイトの陽イオン成分を、有機アンモニウム等に替えることも可能です。この場合、化学的な手法を用いてペロブスカイト化合物を合成できます。このペロブスカイト型化合物には有機成分が含まれていることから、有機無機ペロブスカイト化合物と呼ばれており、金属イオンは主に錫や鉛が用いられます^{4,5)}。一般式で $[(\text{RNH}_3)_m\text{MX}_n]$ などで表され、金属イオンMやハロゲンX、有機基Rを変えることで、その構造や物性を緻密に制御できます。錫の有機無機ペロブスカイト化合物は電気伝導性に優れ⁶⁾、鉛のそれは光物性に優れています⁷⁾。また、ハロゲンを変えるだけでバンドギャップの制御が可能で⁸⁾、原料であるハロゲン化有機オニウム塩とハロゲン化金属化合物に含まれるハロゲンの種類および混合比により、ハロゲンの含有比を変えることが可能です。有機基Rは、メチル基や長鎖アルキル基、フェニル基、ベンジル基、フェネチル基などであり、有機物の骨格の多様性が構造の制御に活かされています。例えば、R = メチルの場合は $[(\text{MeNH}_3)\text{MX}_3]$ の化学組成を持つ3次元の立方晶ペロブスカイト構造を形成します⁹⁾。R = $\text{C}_n\text{H}_{2n+1}$ ($n = 2$ 以上)の場合は、2次元ペロブスカイト層を形成し、アルキル鎖の長さに応じて層間の距離が変化します¹⁰⁾。



有機無機ペロブスカイト型化合物の応用例として、ペロブスカイト太陽電池が挙げられます¹¹⁻¹⁵⁾。この太陽電池には、3次元立方晶を有する $[(\text{MeNH}_3)\text{MX}_3]$ が主に用いられています。また、この太陽電池におけるペロブスカイト構造には、Aサイトへのホルムアミジニウム¹⁶⁾やセシウム¹⁷⁾の導入についても検討されています。近年盛んに研究されているペロブスカイト太陽電池は、他の有機系太陽電池(有機太陽電池(OPV)、色素増感太陽電池(DSSC))のエネルギー変換効率を凌いでおり、溶液塗布による安価な製造プロセスにおいてもデバイスを作成可能です。

文献

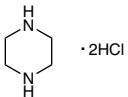
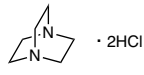
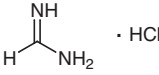
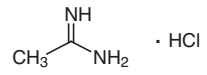
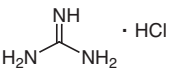
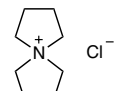
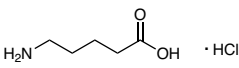
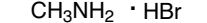
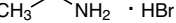
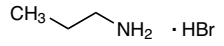
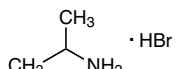
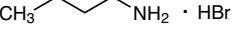
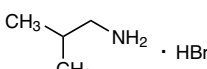
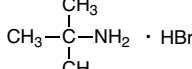
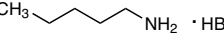
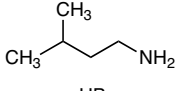
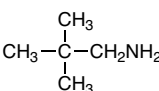
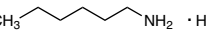
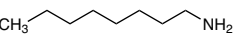
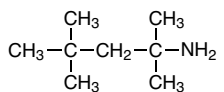
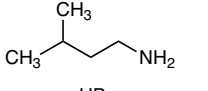
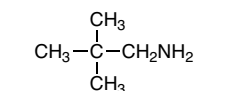
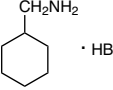
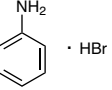
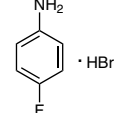
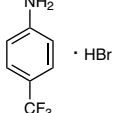
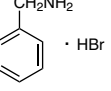
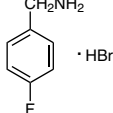
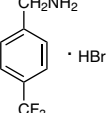
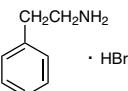
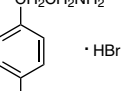
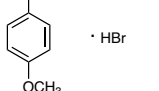
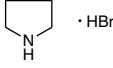
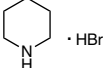
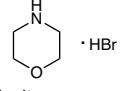
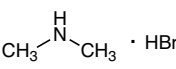
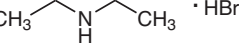
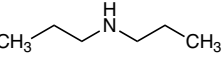
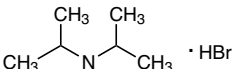
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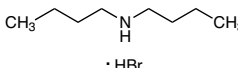
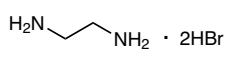
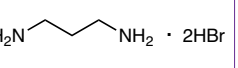
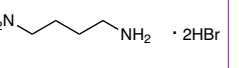
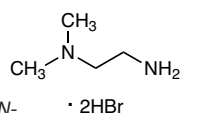
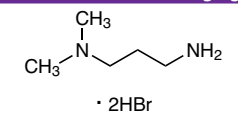
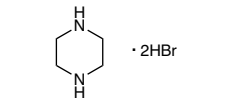
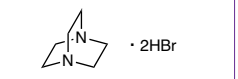
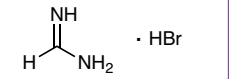
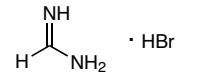
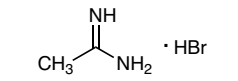
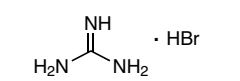
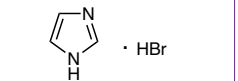
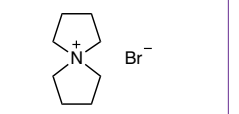
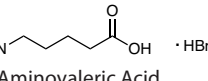
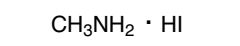
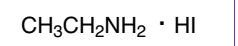
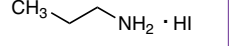
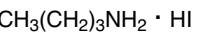
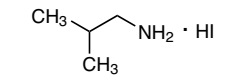
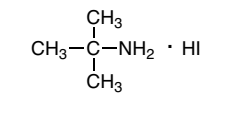
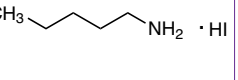
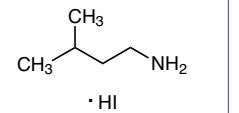
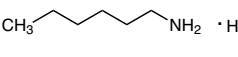
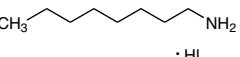
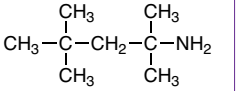
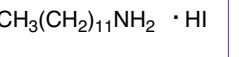
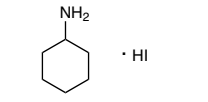
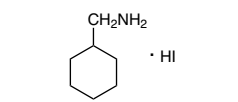
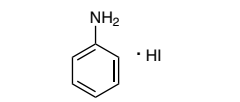
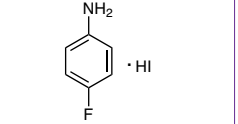
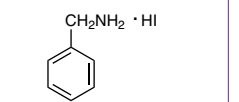
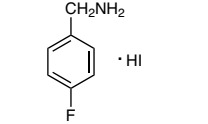
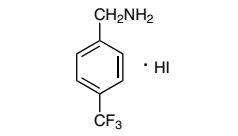
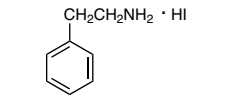
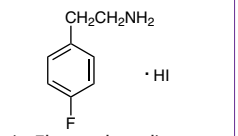
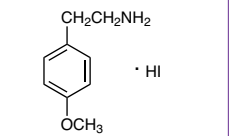
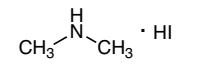
17) M. Saliba, T. Matsui, J.-Y. Seo, K. Domanski, J.-P. Correa-Baena, M. K. Nazeeruddin, S. M. Zakeeruddin, W. Tress, A. Abate, A. Hagfeldt, M. Grätzel, *Energy Environ. Sci.* **2016**, 9, 1989.

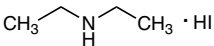
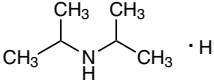
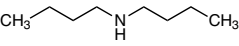
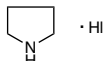

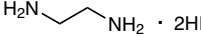
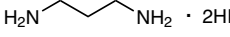
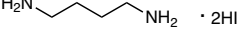
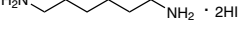
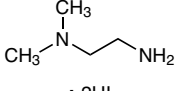
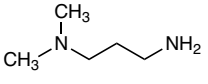
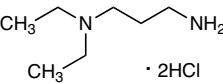
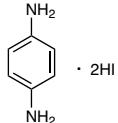
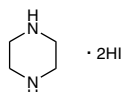
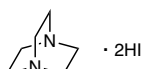
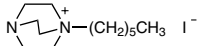
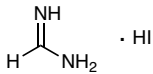
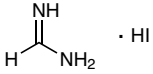
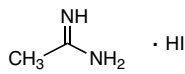
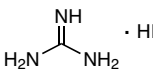
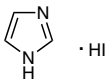
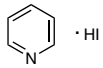
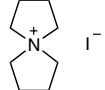
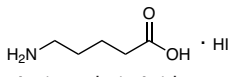
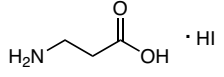
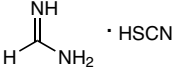
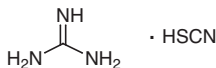
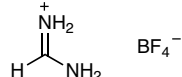
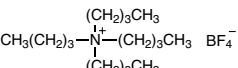
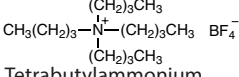
有機オニウム塩

塩化物塩

有機オニウム塩		塩化物塩		M0138 25g 500g $\text{CH}_3\text{NH}_2 \cdot \text{HCl}$ Methylamine Hydrochloride CAS RN: 593-51-1	E0205 25g 500g $\text{CH}_3\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ Ethylamine Hydrochloride CAS RN: 557-66-4
				F1250 1g 5g $\text{FCH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ 2-Fluoroethylamine Hydrochloride CAS RN: 460-08-2	P0522 25g $\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ Propylamine Hydrochloride CAS RN: 556-53-6
I0083 1g 5g $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ Isopentylamine Hydrochloride CAS RN: 541-23-1	P2736 1g 5g $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ Pentylamine Hydrochloride CAS RN: 142-65-4	O0484 1g 5g $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ <i>n</i> -Octylamine Hydrochloride CAS RN: 142-95-0	T3784 1g 5g $\text{CH}_3\text{C}(\text{CH}_3)_2\text{CH}_2\text{C}(\text{CH}_3)_2\text{NH}_2 \cdot \text{HCl}$ <i>tert</i> -Octylamine Hydrochloride CAS RN: 58618-91-0	F1271 5g 25g $\text{NH}_2\text{C}_6\text{H}_4\text{F} \cdot \text{HCl}$ 4-Fluoroaniline Hydrochloride CAS RN: 2146-07-8	
T3833 1g 5g $\text{NH}_2\text{C}_6\text{H}_4\text{CF}_3 \cdot \text{HCl}$ 4-(Trifluoromethyl)aniline Hydrochloride CAS RN: 90774-69-9	B0407 25g 100g 500g $\text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ Benzylamine Hydrochloride CAS RN: 3287-99-8	F1255 1g 5g $\text{FCH}_2\text{C}_6\text{H}_4\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ 4-Fluorobenzylamine Hydrochloride CAS RN: 659-41-6	T3836 1g 5g $\text{CF}_3\text{C}_6\text{H}_4\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ 4-(Trifluoromethyl)benzylamine Hydrochloride CAS RN: 3047-99-2	P0086 25g 100g 500g $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ 2-Phenylethylamine Hydrochloride CAS RN: 156-28-5	
F1256 1g 5g $\text{FCH}_2\text{C}_6\text{H}_4\text{CH}_2\text{CH}_2\text{NH}_2 \cdot \text{HCl}$ 2-(4-Fluorophenyl)ethylamine Hydrochloride CAS RN: 459-19-8	P2488 1g 5g $\text{C}_5\text{H}_{10}\text{N} \cdot \text{HCl}$ Piperidine Hydrochloride (Low water content) CAS RN: 6091-44-7	M3284 5g 25g $\text{C}_4\text{H}_8\text{NO} \cdot \text{HCl}$ Morpholine Hydrochloride CAS RN: 10024-89-2	D0468 25g 500g $\text{CH}_3\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_3 \cdot \text{HCl}$ Diethylamine Hydrochloride CAS RN: 660-68-4	D5856 5g $\text{CH}_3\text{CH}_2\text{CH}_2\text{N}(\text{CH}_2\text{CH}_2\text{CH}_3)_2 \cdot \text{HCl}$ Dibutylamine Hydrochloride CAS RN: 6287-40-7	
D5253 1g 5g $\text{H}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{NH}_2 \cdot 2\text{HCl}$ 1,3-Diaminopropane Dihydrochloride (Low water content) CAS RN: 10517-44-9	D5617 1g 5g $\text{CH}_3\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 \cdot 2\text{HCl}$ <i>N,N</i> -Dimethyl-1,3-propanediamine Dihydrochloride CAS RN: 52198-63-7	D5860 5g $\text{CH}_3\text{N}(\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2)_2 \cdot 2\text{HCl}$ <i>N,N</i> -Diethylethylenediamine Dihydrochloride CAS RN: 52198-62-6	D5861 5g $\text{CH}_3\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 \cdot 2\text{HCl}$ 3-(Dimethylamino)propylamine Dihydrochloride CAS RN: 99310-71-1	A3393 5g $\text{C}_4\text{H}_8\text{N} \cdot 2\text{HCl}$ 2-(1-Pyrrolidinyl)ethanamine Dihydrochloride CAS RN: 65592-36-1	

<p>P2491 1g 5g</p>  <p>Piperazine Dihydrochloride CAS RN: 142-64-3</p>	<p>D5251 1g 5g</p>  <p>1,4-Diazabicyclo[2.2.2]- octane Dihydrochloride CAS RN: 49563-87-3</p>	<p>F0103 5g 25g</p>  <p>Formamidinium Hydrochloride CAS RN: 6313-33-3</p>	<p>A0008 25g 500g</p>  <p>Acetamidinium Hydrochloride CAS RN: 124-42-5</p>	<p>G0162 25g 500g</p>  <p>Guanidine Hydrochloride CAS RN: 50-01-1</p>	
<p>A3092 1g 5g</p>  <p>5-Azoniaspiro[4.4]nonane Chloride CAS RN: 98997-63-8</p>	<p>A0436 1g 5g</p>  <p>5-Aminovaleric Acid Hydrochloride (Low water content) CAS RN: 627-95-2</p>	<p>臭化物塩</p>		<p>M2589 1g 5g 25g</p>  <p>Methylamine Hydrobromide (Low water content) CAS RN: 6876-37-5</p>	<p>E0056 25g 500g</p>  <p>Ethylamine Hydrobromide CAS RN: 593-55-5</p>
<p>P2502 1g 5g</p>  <p>Propylamine Hydrobromide CAS RN: 4905-83-3</p>	<p>I1041 1g 5g</p>  <p>Isopropylamine Hydrobromide CAS RN: 29552-58-7</p>	<p>B5186 1g 5g</p>  <p>Butylamine Hydrobromide CAS RN: 15567-09-6</p>	<p>I1007 1g 5g</p>  <p>Isobutylamine Hydrobromide CAS RN: 74098-36-5</p>	<p>B5187 1g 5g</p>  <p>tert-Butylamine Hydrobromide CAS RN: 60469-70-7</p>	
<p>P2739 1g 5g</p>  <p>Pentylamine Hydrobromide CAS RN: 7334-94-3</p>	<p>I1094 1g 5g</p>  <p>Isopentylamine Hydrobromide CAS RN: 2733412-57-0</p>	<p>N1156 1g 5g</p>  <p>Neopentylamine Hydrobromide</p>	<p>H1678 1g 5g</p>  <p>Hexylamine Hydrobromide CAS RN: 7334-95-4</p>	<p>O0442 1g 5g</p>  <p>n-Octylamine Hydrobromide CAS RN: 14846-47-0</p>	
<p>T3783 1g 5g</p>  <p>tert-Octylamine Hydrobromide CAS RN: 1093859-61-0</p>	<p>D5537 1g 5g</p>  <p>Dodecylamine Hydrobromide CAS RN: 26204-55-7</p>	<p>M3287 1g 5g</p>  <p>2-Methoxyethylamine Hydrobromide CAS RN: 663941-77-3</p>	<p>C3531 1g 5g</p>  <p>Cyclohexanemethylamine Hydrobromide</p>	<p>A2985 1g 5g</p>  <p>Aniline Hydrobromide CAS RN: 542-11-0</p>	
<p>F1272 5g 25g</p>  <p>4-Fluoroaniline Hydrobromide CAS RN: 85734-18-5</p>	<p>T3834 1g 5g</p>  <p>4-(Trifluoromethyl)aniline Hydrobromide CAS RN: 148819-81-2</p>	<p>B5185 1g 5g</p>  <p>Benzylamine Hydrobromide CAS RN: 37488-40-7</p>	<p>F1227 1g 5g</p>  <p>4-Fluorobenzylamine Hydrobromide CAS RN: 2270172-94-4</p>	<p>T3837 1g 5g</p>  <p>4-(Trifluoromethyl)- benzylamine Hydrobromide</p>	
<p>P2388 1g 5g</p>  <p>2-Phenylethylamine Hydrobromide CAS RN: 53916-94-2</p>	<p>F1229 1g 5g</p>  <p>4-Fluorophenethylamine Hydrobromide CAS RN: 1807536-06-6</p>	<p>M3239 1g 5g</p>  <p>2-(4-Methoxyphenyl)- ethylamine Hydrobromide CAS RN: 2705331-53-7</p>	<p>P2484 1g 5g</p>  <p>Pyrrolidine Hydrobromide CAS RN: 55810-80-5</p>	<p>P2487 1g 5g</p>  <p>Piperidine Hydrobromide CAS RN: 14066-85-4</p>	
<p>M3285 5g 25g</p>  <p>Morpholine Hydrobromide CAS RN: 6377-82-8</p>	<p>D5092 1g 5g</p>  <p>Dimethylamine Hydrobromide CAS RN: 6912-12-5</p>	<p>D4667 1g 5g</p>  <p>Diethylamine Hydrobromide CAS RN: 6274-12-0</p>	<p>D5853 5g</p>  <p>Dipropylamine Hydrobromide CAS RN: 7334-96-5</p>	<p>D5768 5g</p>  <p>Diisopropylamine Hydrobromide CAS RN: 30321-74-5</p>	

D5857 5g  Dibutylamine Hydrobromide CAS RN: 10435-44-6	E1221 1g 5g  Ethylenediamine Dihydrobromide CAS RN: 624-59-9	D5090 1g 5g  1,3-Diaminopropane Dihydrobromide CAS RN: 18773-03-0	D5685 1g 5g  1,4-Diaminobutane Dihydrobromide CAS RN: 18773-04-1	D5615 1g 5g  N,N-Dimethylethylenediamine Dihydrobromide CAS RN: 1245570-04-0
D5618 1g 5g  3-(Dimethylamino)propylamine Dihydrobromide CAS RN: 2710685-13-3	P2490 1g 5g  Piperazine Dihydrobromide CAS RN: 59813-05-7	D5250 1g 5g  1,4-Diazabicyclo[2.2.2]octane Dihydrobromide CAS RN: 54581-69-0	F0973 1g 5g 25g  Formamidinium Hydrobromide (Low water content) CAS RN: 146958-06-7	F1244 1g 5g 25g  FABr (99.99%, trace metals basis) CAS RN: 146958-06-7
A3292 1g 5g  Acetamidinium Hydrobromide CAS RN: 1040352-82-6	G0449 1g 5g  Guanidinium Hydrobromide CAS RN: 19244-98-5	I1006 1g 5g  Imidazole Hydrobromide (Low water content) CAS RN: 101023-55-6	A3091 1g 5g  5-Azoniaspiro[4.4]nonane Bromide CAS RN: 16450-38-7	A3094 1g 5g  5-Aminovaleric Acid Hydrobromide (Low water content) CAS RN: 2173111-73-2
ヨウ化物塩	M2556 1g 5g 25g 100g  Methylamine Hydroiodide (Low water content) CAS RN: 14965-49-2	E1045 1g 5g  Ethylamine Hydroiodide CAS RN: 506-58-1	P2212 1g 5g  Propylamine Hydroiodide CAS RN: 14488-45-0	B4433 1g 5g  Butylamine Hydroiodide CAS RN: 36945-08-1
	I0935 1g 5g  Isobutylamine Hydroiodide CAS RN: 205508-75-4	B4434 1g 5g  tert-Butylamine Hydroiodide CAS RN: 39557-45-4	P2740 1g 5g  Pentylamine Hydroiodide CAS RN: 60762-85-8	I1095 1g 5g  Isopentylamine Hydroiodide CAS RN: 2733412-76-3
H1679 5g  1-Hexanamine Hydroiodide CAS RN: 54285-91-5	O0485 1g 5g  1-Octanamine Hydroiodide CAS RN: 60734-63-6	T3785 1g 5g  tert-Octylamine Hydroiodide	D5538 1g 5g  Dodecylamine Hydroiodide CAS RN: 34099-97-3	C3532 1g 5g  Cyclohexylamine Hydroiodide CAS RN: 45492-87-3
C3425 1g 5g  Cyclohexylmethylamine Hydroiodide CAS RN: 2153504-15-3	A2778 1g 5g  Aniline Hydroiodide CAS RN: 45497-73-2	F1273 1g 5g  4-Fluoroaniline Hydroiodide CAS RN: 85734-19-6	B4566 1g 5g  Benzylamine Hydroiodide (Low water content) CAS RN: 45579-91-7	F1228 1g 5g  4-Fluorobenzylamine Hydroiodide CAS RN: 2097121-30-5
T3838 1g 5g  4-(Trifluoromethyl)benzylamine Hydroiodide	P2213 1g 5g  2-Phenylethylamine Hydroiodide CAS RN: 151059-43-7	F1203 1g 5g  2-(4-Fluorophenyl)ethylamine Hydroiodide CAS RN: 1413269-55-2	M3240 1g 5g  2-(4-Methoxyphenyl)ethylamine Hydroiodide	D4555 1g 5g  Dimethylamine Hydroiodide CAS RN: 51066-74-1

<p>D4643 1g 5g</p>  <p>Diethylamine Hydroiodide CAS RN: 19833-78-4</p>	<p>D5769 5g</p>  <p>Diisopropylamine Hydroiodide CAS RN: 132396-99-7</p>	<p>D5858 5g</p>  <p>Dibutylamine Hydroiodide CAS RN: 79886-80-9</p>	<p>P2486 1g 5g</p>  <p>Pyrrolidine Hydroiodide CAS RN: 45361-12-4</p>	<p>M3286 5g 25g</p>  <p>Morpholine Hydroiodide CAS RN: 58464-45-2</p>
<p>E1222 1g 5g</p>  <p>Ethylenediamine Dihydroiodide CAS RN: 5700-49-2</p>	<p>D5091 1g 5g</p>  <p>1,3-Diaminopropane Dihydroiodide CAS RN: 120675-53-8</p>	<p>D5686 1g 5g</p>  <p>1,4-Diaminobutane Dihydroiodide CAS RN: 916849-52-0</p>	<p>D6035 1g 5g</p>  <p>1,6-Hexanediamine Dihydroiodide CAS RN: 20208-23-5</p>	<p>D5616 1g 5g</p>  <p>N,N-Dimethylethylenediamine Dihydroiodide CAS RN: 244234-52-4</p>
<p>D5619 1g 5g</p>  <p>N,N-Dimethyl-1,3-propanediamine Dihydroiodide CAS RN: 2561497-43-4</p>	<p>D5861 5g</p>  <p>3-(Dimethylamino)propylamine Dihydroiodide CAS RN: 99310-71-1</p>	<p>P2389 1g</p>  <p>1,4-Phenylenediamine Dihydroiodide CAS RN: 116469-02-4</p>	<p>P2492 1g 5g</p>  <p>Piperazine Dihydroiodide CAS RN: 58464-47-4</p>	<p>D5252 1g 5g</p>  <p>1,4-Diazabicyclo[2.2.2]octane Dihydroiodide CAS RN: 33322-06-4</p>
<p>H1759 5g</p>  <p>1-Hexyl-1,4-diazabicyclo[2.2.2]octan-1-ium Iodide CAS RN: 1009321-13-4</p>	<p>F0974 1g 5g 25g 100g</p>  <p>Formamidine Hydroiodide (Low water content) CAS RN: 879643-71-7</p>	<p>F1263 1g 5g 25g</p>  <p>Formamidine Hydroiodide (99.99%, trace metals basis) CAS RN: 879643-71-7</p>	<p>A2902 1g 5g</p>  <p>Acetamidine Hydroiodide (Low water content) CAS RN: 1452099-14-7</p>	<p>G0450 1g 5g</p>  <p>Guanidine Hydroiodide CAS RN: 19227-70-4</p>
<p>I0970 1g 5g</p>  <p>Imidazole Hydroiodide (Low water content) CAS RN: 68007-08-9</p>	<p>P2672 5g</p>  <p>Pyridine Hydroiodide CAS RN: 18820-83-2</p>	<p>A3093 1g 5g</p>  <p>5-Azoniaspiro[4.4]nonane Iodide CAS RN: 45650-35-9</p>	<p>A2984 1g 5g</p>  <p>5-Aminovaleric Acid Hydroiodide (Low water content) CAS RN: 1705581-28-7</p>	<p>A3112 1g 5g</p>  <p>β-Alanine Hydroiodide (Low water content) CAS RN: 2096495-59-7</p>
<p>擬ハロゲン化物塩</p>				
<p>M2991 1g 5g</p> <p>CH₃NH₂ · HSCN</p> <p>Methylamine Thiocyanate CAS RN: 61540-63-4</p>	<p>F1153 1g 5g</p>  <p>Formamidine Thiocyanate CAS RN: 1821033-48-0</p>	<p>G0230 25g 500g</p>  <p>Guanidine Thiocyanate CAS RN: 593-84-0</p>	<p>F1152 1g 5g</p>  <p>Formamidinium Tetrafluoroborate CAS RN: 2607106-18-1</p>	
<p>M2990 1g 5g</p> <p>CH₃NH₃⁺ BF₄⁻</p> <p>Methylamine Tetrafluoroborate CAS RN: 42539-74-2</p>	<p>M2989 1g 5g</p> <p>CH₃NH₃⁺ PF₆⁻</p> <p>Methylammonium Hexafluorophosphate CAS RN: 28302-50-3</p>	<p>M3134 1g 5g</p> <p>CH₃NH₂ · HO-CN</p> <p>Methylamine Cyanate CAS RN: 63405-91-4</p>	<p>T0914 25g 100g 500g</p>  <p>Tetrabutylammonium Tetrafluoroborate CAS RN: 429-42-5</p>	<p>T2648 25g</p>  <p>Tetrabutylammonium Tetrafluoroborate (Br < 0.02 %) CAS RN: 429-42-5</p>
<p>ハロゲン化鉛</p>				
<p>L0279 1g 5g 25g 100g 1kg</p> <p>PbI₂</p> <p>Lead(II) Iodide (99.99%, trace metals basis) [for Perovskite precursor] CAS RN: 10101-63-0</p>	<p>L0288 1g 5g 25g</p> <p>PbBr₂</p> <p>Lead(II) Bromide [for Perovskite precursor] CAS RN: 10031-22-8</p>	<p>L0346 1g 5g 25g</p> <p>PbBr₂</p> <p>Lead(II) Bromide (Low water content) [for Perovskite precursor] CAS RN: 10031-22-8</p>		

L0291 1g 5g PbCl₂ Lead(II) Chloride (purified by sublimation) [for Perovskite precursor] CAS RN: 7758-95-4	L0292 1g 5g 25g PbCl₂ Lead(II) Chloride [for Perovskite precursor] CAS RN: 7758-95-4	C3569 1g 5g CsPbBr₃ Cesium Lead Tribromide (Low water content) CAS RN: 15243-48-8	C3570 1g 5g CsPbI₃ Cesium Lead Triiodide (Low water content) CAS RN: 18041-25-3	
その他の鉛化合物		L0315 1g 5g 25g $\left[\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^- \right]_2 \text{Pb}^{2+}$ Lead(II) Acetate [for Perovskite precursor] CAS RN: 301-04-2	L0330 25g 100g $\left[\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^- \right]_2 \text{Pb}^{2+} \cdot 3\text{H}_2\text{O}$ Lead(II) Acetate Trihydrate CAS RN: 6080-56-4	
		ハロゲン化セシウム		C2202 25g 100g CsBr Cesium Bromide CAS RN: 7787-69-1
ハロゲン化ビスマス				B5787 5g 25g BiI₃ Bismuth(III) Iodide Anhydrous CAS RN: 7787-64-6
		ハロゲン化スズ		T3449 1g 5g SnI₂ Tin(II) Iodide [for Perovskite precursor] CAS RN: 10294-70-9

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