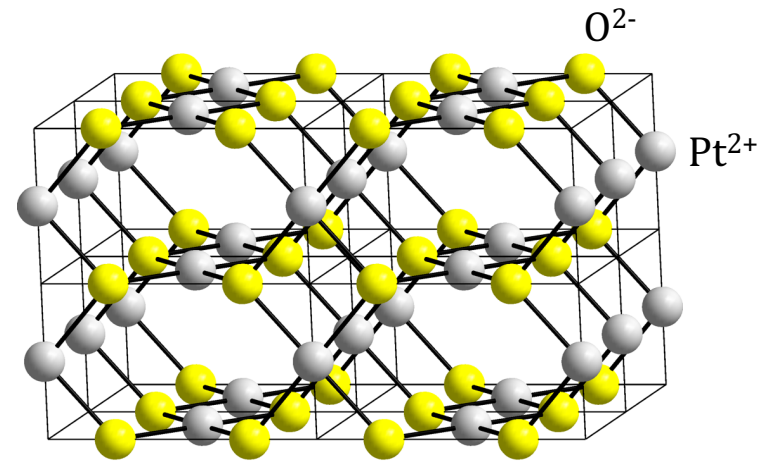


# PtO



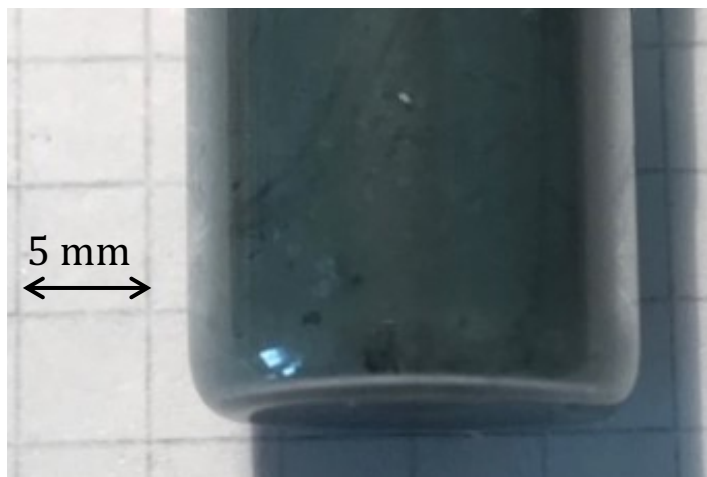
Optical image of PtO sample



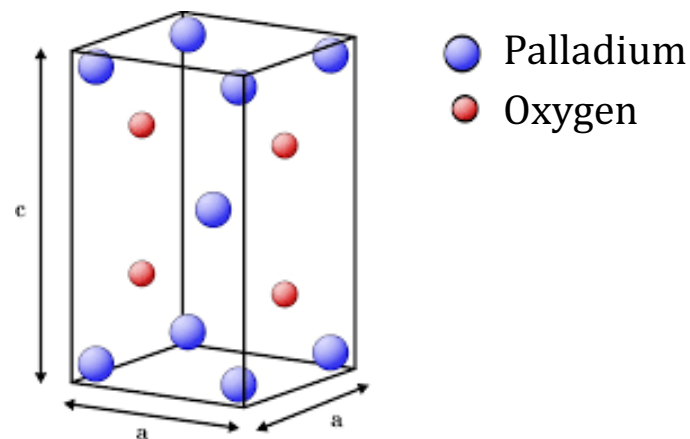
PtO crystallizes in tetragonal symmetry with P4/mmc space group

Oxygen interacts with Pt surfaces in catalyst devices, which play a crucial role in the formation layers, which can affect the reactivity of Pt-base catalysts. The **experimental data for PtO is very limited** and contradicted. Doubts remain even for the bulk PtO structures. Ref.: [Phys. Rev. B 84, 100101\(R\) \(2011\)](#)

# PdO



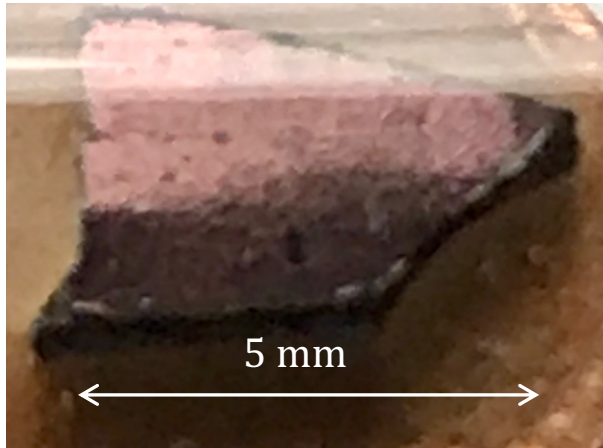
Optical image of PdO sample



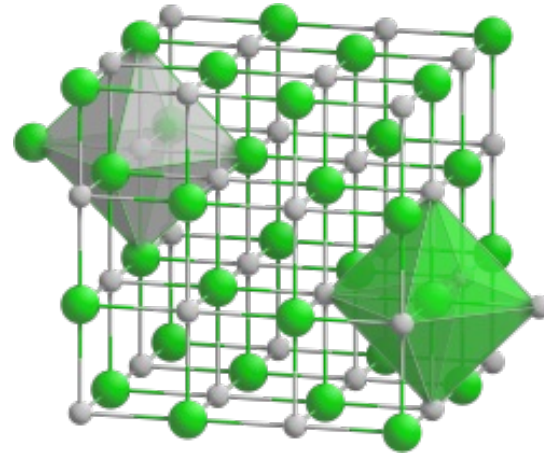
PdO crystallizes in tetragonal space group ( $P42/mmc$ )  
 $a=3.044$ ,  $c=5.328$  Å

PdO is often obtained as a poorly defined material that is generated for applications as a catalyst. Palladium oxide is prepared by heating palladium sponge metal in oxygen at 350 °C.  $2 \text{ Pd} + \text{O}_2 \rightarrow 2 \text{ PdO}$ . The oxide is obtained as a black powder. Ref.: [Wikipedia](https://en.wikipedia.org/wiki/Palladium_oxide)

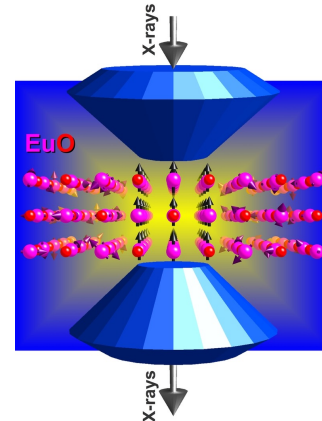
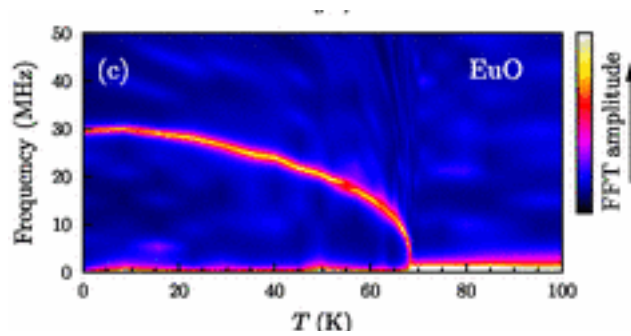
# EuO



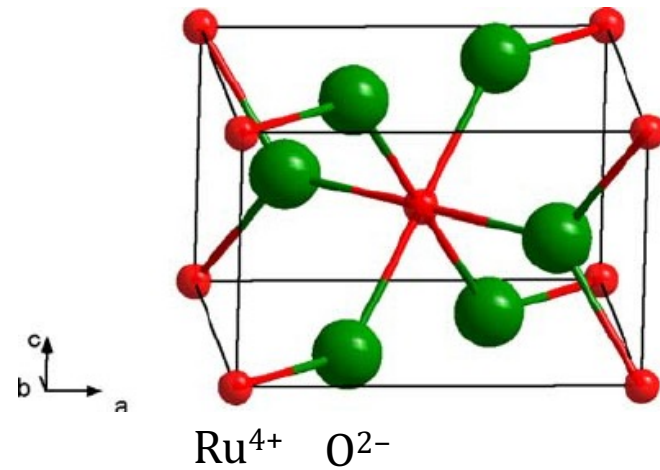
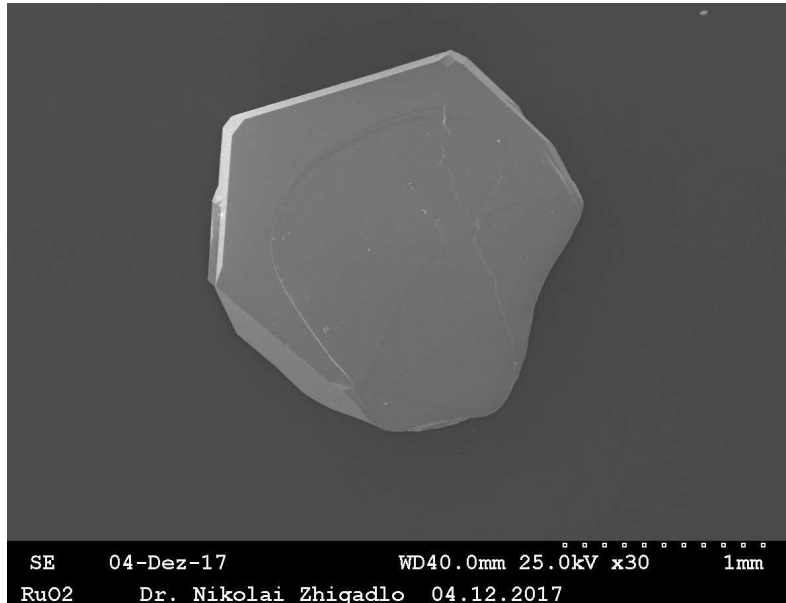
Optical image of EuO sample



EuO crystallizes in a NaCl structure



EuO: semiconductor and ferromagnet for spintronics. Ref.: [New J Phys 12 \(2010\) 113041](#)

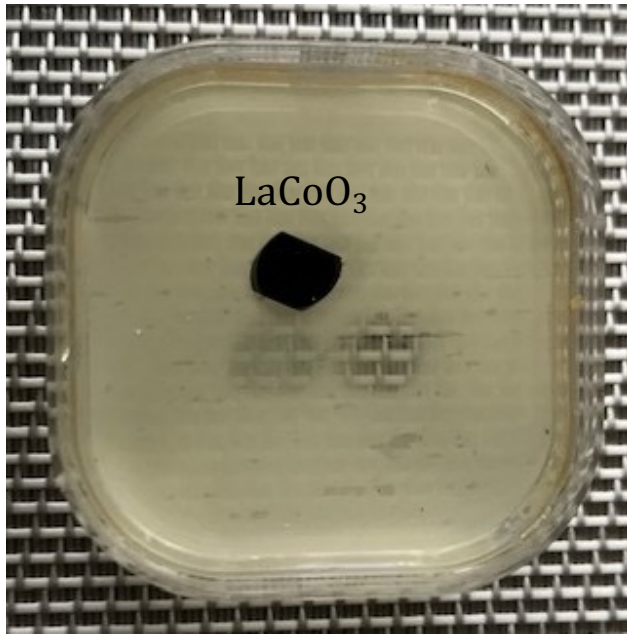


Crystal structure of  $\text{RuO}_2$

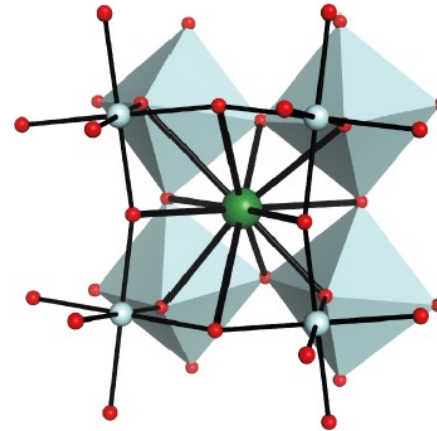
SEM image of a single crystal  $\text{RuO}_2$

For decades, it has been considered as a Pauli paramagnet. Recent neutron study on a bulk crystal of  $\text{RuO}_2$  revealed the presence of itinerant, **above-room-temperature antiferromagnetism** ( $T_{\text{Neel}} > 300 \text{ K}$ ). Useful for potential applications in antiferromagnetic spintronic devices. Ref.: [Phys. Rev. Lett. 122, 017202 \(2019\)](#)

# LaCoO<sub>3</sub>



Picture of LaCoO<sub>3</sub> crystal  
The size is about 6 mm



LaCoO<sub>3</sub> crystallizes with trigonal crystal structure of rhombohedral symmetry, space group *R3c* (No. 167). The La cation is surrounded by 12 oxygen atoms. The La, Co and O atoms are depicted as green, cyan and red spheres respectively.

[Phys. Stat. Sol. A 216, 6 \(2019\) 1800736](#)

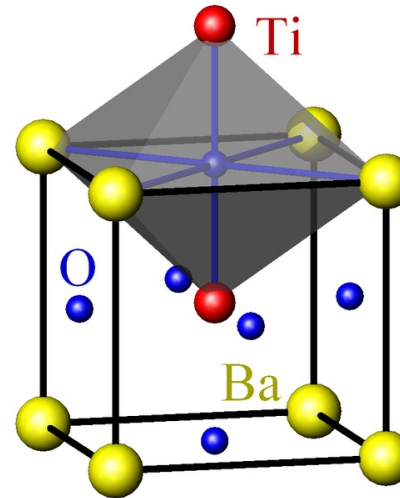
LaCoO<sub>3</sub> shows a variety of interesting properties that are desirable for environmentally friendly energy solutions, fuel cell technologies, novel diesel engines, and oxyfuel power plants. However, **the true spin state of the Co<sup>3+</sup> ion is an important but still unresolved issue** that underlies these applications.

Ref.: [PRL 125, 177202 \(2020\)](#); [PRB 100, 054306 \(2019\)](#)

# BaTiO<sub>3</sub>



Image of small BaTiO<sub>3</sub> crystals



Crystal structure of BaTiO<sub>3</sub>, with emphasis on the coordination polyhedron of oxygen.

Ref.: [Wikimedia](#)

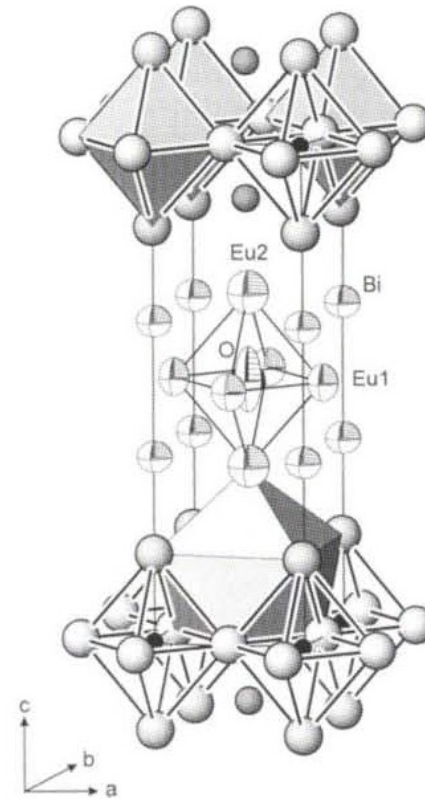
BaTiO<sub>3</sub> is a **ferroelectric** material that exhibits the photorefractive effect and piezoelectric properties. It is used in capacitors, electromechanical transducers and nonlinear optics. Ref: [Wikipedia](#)

# $\text{Eu}_4\text{Bi}_2\text{O}$



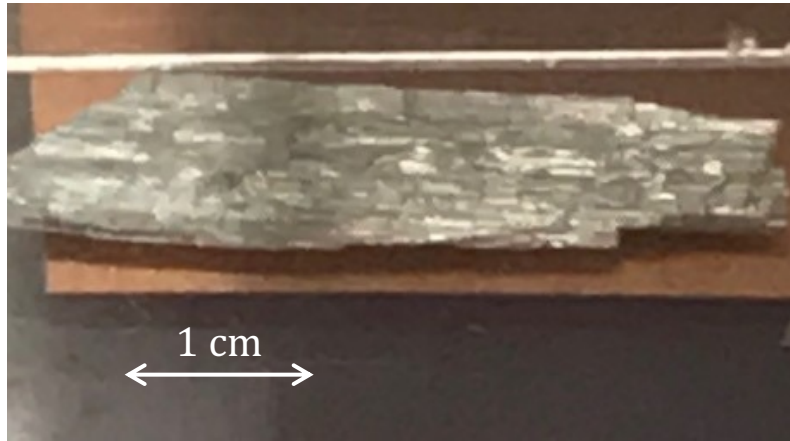
Optical image of  $\text{Eu}_4\text{Bi}_2\text{O}$  sample.

$\text{Eu}_4\text{Bi}_2\text{O}$  belongs to the  $\text{A}_4\text{X}_2\text{O}$  family of anti-Ruddlesden-Popper materials showing ferroelectric and antiferroelectric behaviours. Ref.: [PNAS 118 \(2021\)](#)

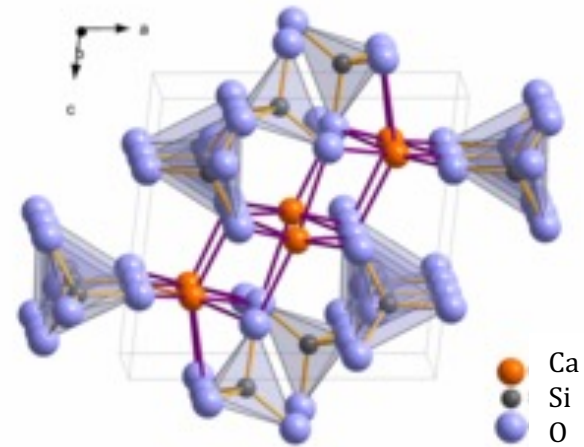


$\text{Eu}_4\text{Bi}_2\text{O}$  is  $(\text{La}, \text{Ba})\text{CuO}_4$  structured and crystallizes in the tetragonal  $I4/mmm$  space group.

Ref.: [Zeitschrift für Kristallographie 216, 16 \(1998\)](#).



Optical image of Wollastonite – calcium silicate mineral CaSiO<sub>3</sub>

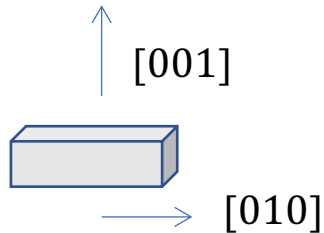


The unit cell of triclinic CaSiO<sub>3</sub>. This formula may also be written as Ca(Si<sub>3</sub>O<sub>9</sub>)<sub>0.33</sub> or as Ca<sub>3</sub>(Si<sub>3</sub>O<sub>9</sub>).

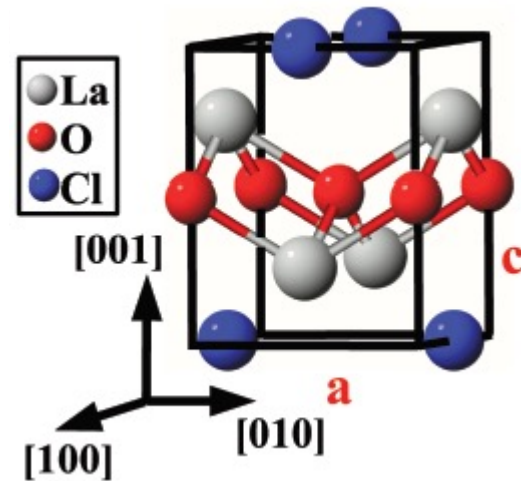
Canadian Wollastonite is a little-known a relatively **rarely-occurring mineral** with a pearly luster on **cleavage surfaces** and a granular texture. Ref.: [Wikipedia.org](https://en.wikipedia.org/wiki/Wollastonite)

# LaOCl

Well-developed LaOCl microplates ( $\sim 40 \times 40 \times 10 \mu\text{m}^3$ ) were grown under high pressure. Space group  $P4/nmm$ , tetragonal  $a = b = 4.12 \text{ \AA}$ ;  $c = 6.879 \text{ \AA}$ .



Crystal morphology of LaOCl crystal

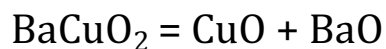


Crystal structure of LaOCl

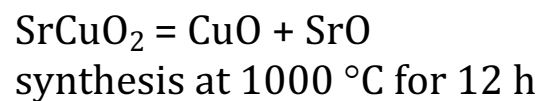
LaOCl is an inorganic material with a wide scope of applications ranging from catalysis to luminescent materials, ion conductors, and gas sensors.



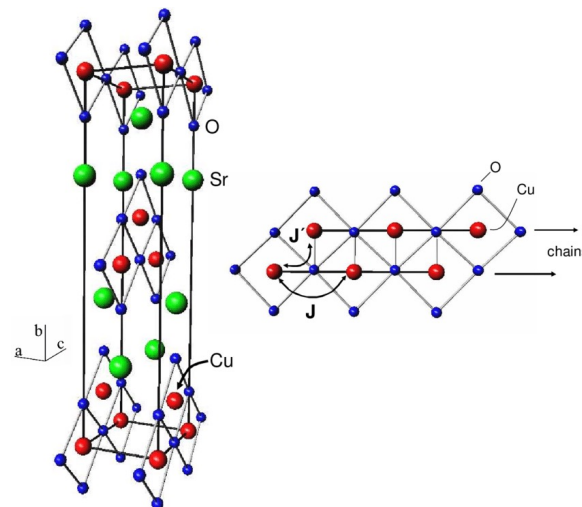
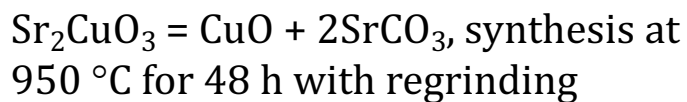
An illustrative image of powdered sample BaCuO<sub>2</sub>



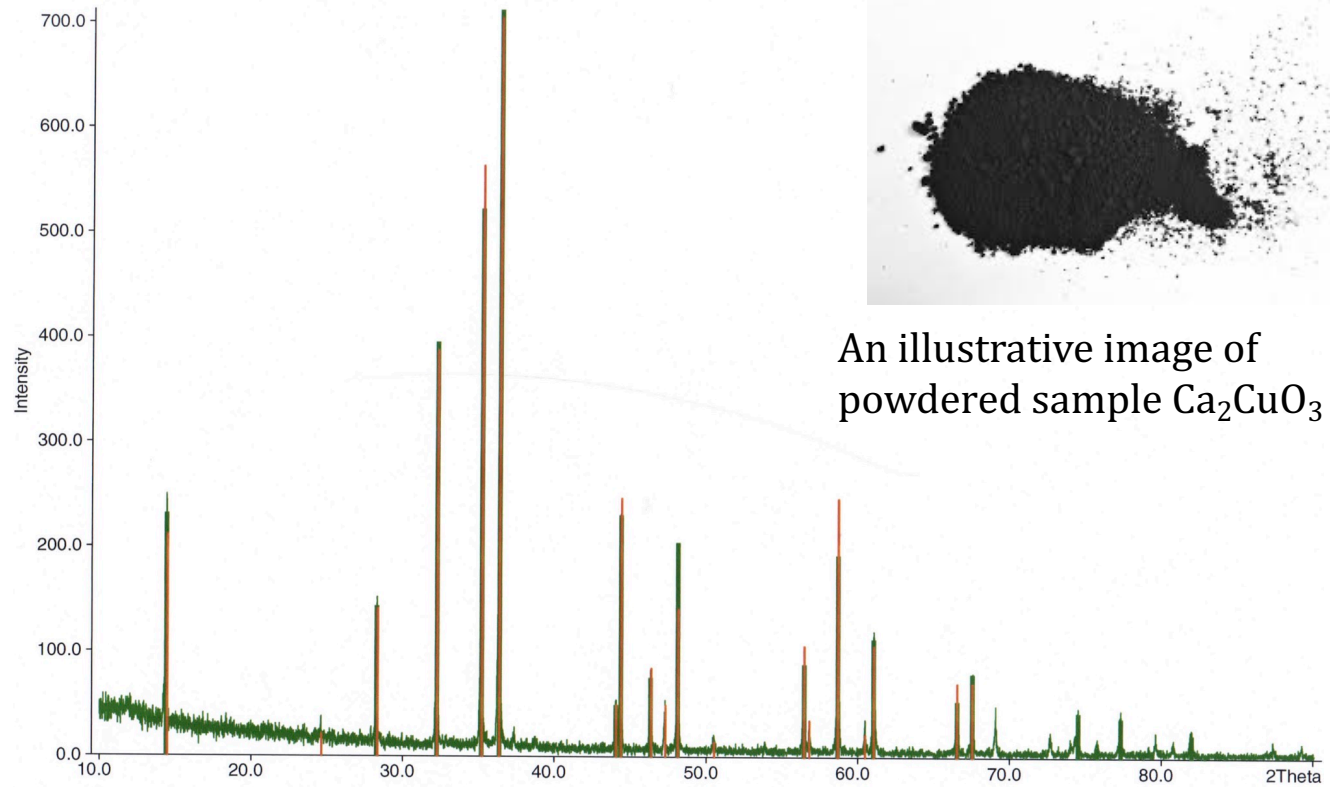
An illustrative image of powdered sample SrCuO<sub>2</sub>



An illustrative image of powdered sample Sr<sub>2</sub>CuO<sub>3</sub>

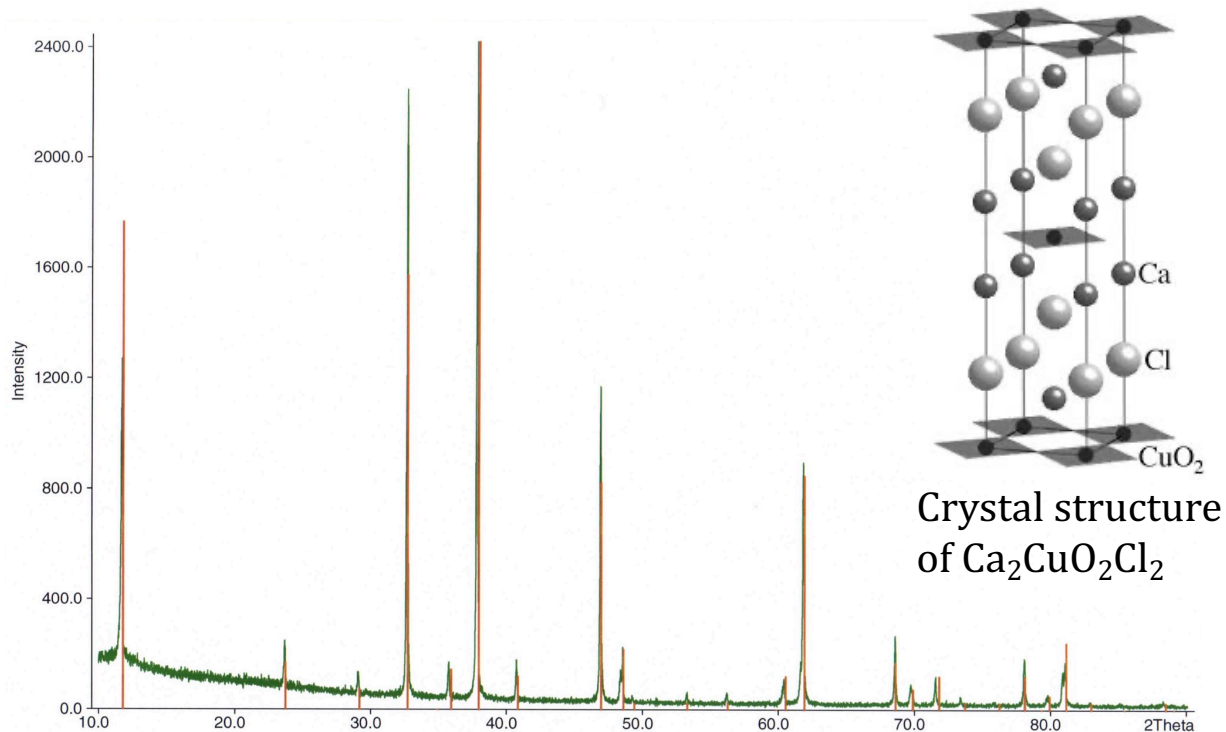


Crystal structure of SrCuO<sub>2</sub>



Powder diffraction pattern of  $\text{Ca}_2\text{CuO}_3$  sample

$\text{Ca}_2\text{CuO}_3 = \text{CuO} + 2\text{CaCO}_3$ , synthesis at 1000 °C for 20 h with regrinding



Powder diffraction pattern of  $\text{Ca}_2\text{CuO}_2\text{Cl}_2$  sample

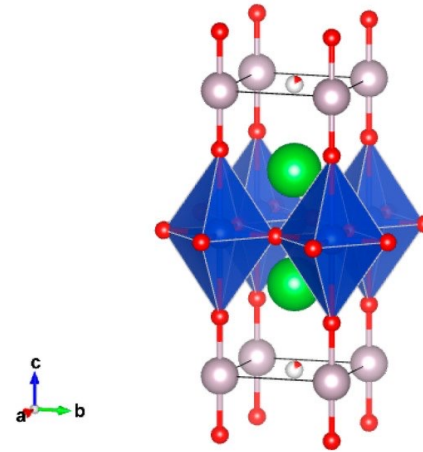
$\text{Ca}_2\text{CuO}_2\text{Cl}_2 = 0.5\text{Ca}_2\text{CuO}_3 + 0.5\text{CuO} + \text{CaCl}_2$ , synthesis at 750 °C for 72 h in Ar flow atmosphere. Lattice parameters:  $a = 3.8687 \text{ \AA}$ ;  $c = 15.0485 \text{ \AA}$



$\text{Ca}_3\text{Cu}_2\text{O}_4\text{Cl}_2 = \text{Ca}_2\text{CuO}_3 + \text{CuO} + \text{CaCl}_2$ , synthesis at 800 °C for several days in oxygen gas flow atmosphere.



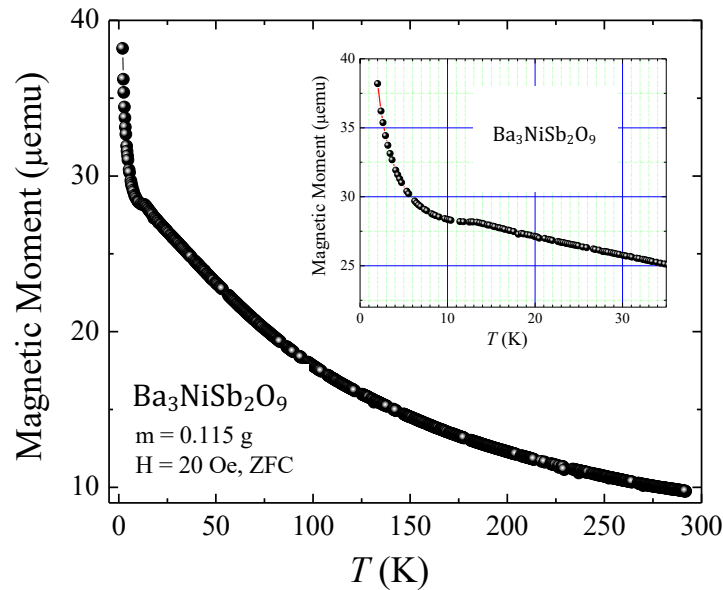
An illustrative image of powdered sample Hg-1201



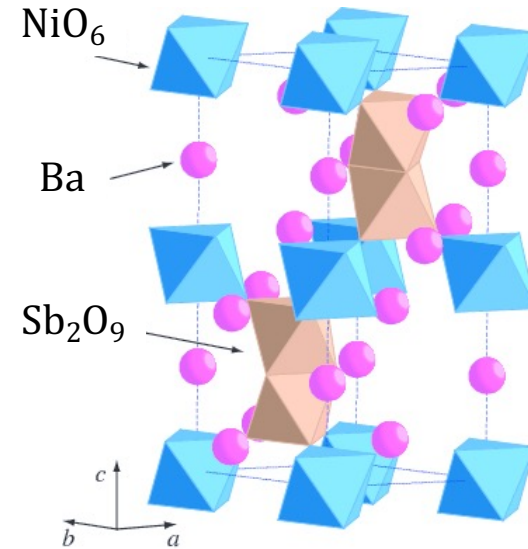
Crystal structure of Hg-1201

# Ba<sub>3</sub>NiSb<sub>2</sub>O<sub>9</sub>

Ba<sub>3</sub>NiSb<sub>2</sub>O<sub>9</sub> is the **spin liquid candidate** material



Magnetic moment as a function of temperature showing antiferromagnetic ordering at **T<sub>N</sub> = 13.5 K** of Ba<sub>3</sub>NiSb<sub>2</sub>O<sub>9</sub> sample.



Ba<sub>3</sub>NiSb<sub>2</sub>O<sub>9</sub> crystallizes in space group *P6<sub>3</sub>/mmc*, and consist of corner-shared NiO<sub>6</sub> octahedra and face-sharing Sb<sub>2</sub>O<sub>9</sub> bioctahedra. Dotted lines denote the chemical unit cell.

Polycrystalline Ba<sub>3</sub>NiSb<sub>2</sub>O<sub>9</sub> sample synthesized by high pressure method