Nickel oxide hydroxide wikipedia

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Nickel oxide hydroxide is the inorganic compound with the chemical formula NiO(OH). It is a black solid that is insoluble in all solvents but attacked by base and acid. It is a component of the nickel-metal hydride battery and of the nickel-iron battery.

Nickel(III) oxides are often poorly characterized and are assumed to be nonstoichiometric compounds. Nickel(III) oxide (Ni2O3) has not been verified crystallographically. For applications in organic chemistry, nickel oxides or peroxides are generated in situ and lack crystallographic characterization. For example, "nickel peroxide" (CAS# 12035-36-8) is also closely related to or even identical with NiO(OH).[1]

Its layered structure resembles that of the brucite polymorph of nickel(II) hydroxide, but with half as many hydrogens. The oxidation state of nickel is 3+.[2] It can be prepared by the reaction of nickel(II) hydroxide with aqueous potassium hydroxide and bromine as the oxidant:[3]

Nickel(II) hydroxide is the inorganic compound with the formula Ni(OH)2. It is a lime-green solid that dissolves with decomposition in ammonia and amines and is attacked by acids. It is electroactive, being converted to the Ni(III) oxy-hydroxide, leading to widespread applications in rechargeable batteries.[6]

Nickel(II) hydroxide is frequently used in electrical car batteries.[8] Specifically, Ni(OH)2 readily oxidizes to nickel oxyhydroxide, NiOOH, in combination with a reduction reaction, often of a metal hydride (reaction 1 and 2).[12][13]

Of the two polymorphs, a-Ni(OH)2 has a higher theoretical capacity and thus is generally considered to be preferable in electrochemical applications. However, it transforms to v-Ni(OH)2 in alkaline solutions, leading to many investigations into the possibility of stabilized a-Ni(OH)2 electrodes for industrial applications.[9]

The synthesis entails treating aqueous solutions of nickel(II) salts with potassium hydroxide. When the same reaction is conducted in the presence of bromine, the product is Ni3O2(OH)4.[14]

NiO adopts the NaCl structure, with octahedral Ni2+ and O2− sites. The conceptually simple structure is commonly known as the rock salt structure. Like many other binary metal oxides, NiO is often non-stoichiometric, meaning that the Ni:O ratio deviates from 1:1. In nickel oxide, this non-stoichiometry is accompanied by a color change, with the stoichiometrically correct NiO being green and the non-stoichiometric NiO being black.

NiO has a variety of specialized applications and generally, applications distinguish between "chemical grade", which is relatively pure material for specialty applications, and "metallurgical grade", which is mainly used for the production of alloys. It is used in the ceramic industry to make frits, ferrites, and porcelain glazes. The sintered oxide is used to produce nickel steel alloys. Charles ?douard Guillaume won the 1920 Nobel Prize in Physics for his work on nickel steel alloys which he called invar and elinvar.

About 4000 tons of chemical grade NiO are produced annually.[5] Black NiO is the precursor to nickel salts, which arise by treatment with mineral acids. NiO is a versatile hydrogenation catalyst.

Heating nickel oxide with either hydrogen, carbon, or carbon monoxide reduces it to metallic nickel. It combines with the oxides of sodium and potassium at high temperatures (>700 ?C) to form the corresponding nickelate.[6]

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