

BORON

Isotopes $^{10}_5\text{B}$ and $^{11}_5\text{B}$	1st Ionization energy 800.6 kJ/mol
Earth's crust abundance $8.7 \times 10^{-4} \%$	Common oxidation num. 3
Electron configuration $1s^2 2s^2 2p^1$	Physical state solid
Melting point 2076°C	Discovery date 1808
Boiling point 3927°C	Discoverer J. Gay Lussac
Density 2.46 g/L	Place Discovered France

Introduction

- Boron is a metalloid forming strong covalently bonded compounds.
- It is poor conductor of heat and electricity.
- It is found in various crystalline structure. It is the second hardest element after diamond.
- It has amphoteric character.

1. Occurrence

- The most important minerals borax ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$), kernite ($\text{Na}_2\text{B}_4\text{O}_7 \cdot 4\text{H}_2\text{O}$) and colemanite ($\text{CaB}_6\text{O}_{11} \cdot 5\text{H}_2\text{O}$).

Preparation

- First obtained by Gay-Lussac in 1808 from B_2O_3 .
 $\text{B}_2\text{O}_3 + 6\text{K} \rightarrow 3\text{K}_2\text{O} + 2\text{B}$
- Today in industry,
 $\text{B}_2\text{O}_3 + 3\text{Mg} \rightarrow 3\text{MgO} + 2\text{B}$

2. Chemical Properties

- In compounds boron has +3 oxidation state.
 $4\text{B} + 3\text{O}_2 \rightarrow \text{B}_2\text{O}_3$
- It is used as hydrogen fuel producer.
 $2\text{B} + 3\text{H}_2\text{O} \rightarrow \text{B}_2\text{O}_3 + 3\text{H}_2$ ($700^\circ\text{C} - 800^\circ\text{C}$)
 $\text{B} + 3\text{HNO}_3(\text{conc}) \rightarrow \text{H}_3\text{BO}_3 + 3\text{NO}_2$
 $2\text{B} + \text{N}_2 \rightarrow 2\text{BN}$

3. Compounds

- Boranes are compounds of boron with hydrogen. Some derivatives of boranes are used as fuel for rockets and turbo jet engines.
- Boric acid, H_3BO_3 or $\text{B}(\text{OH})_3$, is weak acid, obtained from the reaction of boron with strong sulfuric acid or nitric acid and used in medicine as antiseptic.
- Borax, $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$, is used to prepare standard HCl solutions.

Uses

- It is used in the manufacture of steel and light weight alloys.
- Boron-10 isotope is used as moderator in control rods in nuclear reactors. It is a good absorber of neutron.
- It is used in flares to give green color.
- Some boron compounds used in fiberglass insulation, textile products, ceramics and eye disinfectants.
- Borosilicate glasses are resistant to rapid heating and cooling. Pyrex glass is used in kitchens and laboratories.
- Today scientists believe that boron is an important element for the future's energy source.