Nickel

Commercially pure or low-alloy nickel has characteristics that are useful in several fields, notably chemical
processing. Nickel is highly resistant to various reducing chemicals and is unexcelled in resistance to caustic alkalis. Nickel 201 is a commercially pure nickel with high thermal conductivity.

Nickel 201

Nickel 201 is commercially pure (99.6%) wrought nickel and a low carbon version of Nickel 200. It has good mechanical properties and excellent resistance to many corrosive environments. Other useful features: high thermal and electrical conductivities, low gas content and low vapour pressure. The corrosion resistance makes it particularly useful for maintaining product purity in the handling of foods, liquids, synthetic fibers, and caustic alkali's.

High-temperature and Corrosion Resistance properties

Nickel 201 has the excellent corrosion resistance characteristic of Nickel 200. Because it is a low-carbon material (0.02% max.), Nickel 201 is not subject to embrittlement by intergranularly precipitated carbon or graphite when held at temperatures of 315° to 760°C for extended times, provided carbonaceous materials are not in contact with it. It is, therefore, preferred to Nickel 200 in all cases where temperatures exceed 315°C.

Nickel 201 is ideal for laboratory crucibles which are capable of withstanding oxidizing furnace atmospheres up to 1100°C. Above 300°C its mechanical properties change: tensile strength falls, elongation grows making for example a crucible more malleable when handling or when heated by a direct flame. This can lead to a change in the profile/shape of a crucible.

The material is subject to intergranular embrittlement by sulphur compounds at temperatures above 315°C.

Water

The resistance of Nickel 201 to corrosion by distilled and natural waters is excellent since resistant to water containing hydrogen sulphide or carbon dioxide. Nickel 201 gives excellent service in seawater.

Acids

Sulphuric

Nickel 201 can be used with Sulphuric acid at low or moderate temperatures.

Hydrochloric

According to the data available, Nickel 201 may be used in hydrochloric acid in concentrations up to 30%, at room temperature. Increasing temperature will accelerate corrosion. If oxidizing salts are present in any but very small amounts, corrosion will be increased. At less than 0.5% concentration, the material can be used satisfactorily up to 150°-205°C.

Hydrofluoric

Nickel 201 has excellent resistance to anhydrous hydrofluoric acid even at elevated temperatures. In aqueous solutions, however, service is usually limited to below 80°C. Even at room temperature, 60-65%
commercial-grade acid has been found to severely corrode Nickel 201.

Phosphoric

Nickel 201 is resistant to phosphoric acid.

Nitric

Nickel 201 should not be used in nitric acid.

Organic

In general, Nickel 201 has excellent resistance to organic acids of all concentrations.

Alkali's

The outstanding corrosion resistance characteristic of Nickel 201 is its resistance to caustic soda and other
Alkali's. (Ammonium hydroxide is an exception. Nickel 201 is not attacked by anhydrous ammonia or ammonium hydroxide in concentrations of 1%. Stronger concentrations can cause rapid attack.)

In caustic soda, Nickel 201 has excellent resistance to all concentrations up to and including the molten state. Below 50%, rates are negligible, even in boiling solutions. As concentration and temperature increase, corrosion rates increase very slowly. The chief factor contributing to the outstanding performance of Nickel 201 in highly concentrated caustic soda is a black protective film that forms during exposure.
This film – nickel oxide – results in a marked decrease in corrosion rates over long exposure under most conditions. Because the presence of chlorates in caustic increases corrosion rates significantly, every effort should be made to remove as much of them as possible.

Results of tests in sodium hydroxide solutions of varying concentrations produces a typical thin black oxide film, found on some of the samples in the tests at boiling temperature.

Oxidizable sulphur compounds are also harmful, but, by adding sodium peroxide to change them to sulphates, their effect can be minimized.

Salts

The metal is not subject to stress-corrosion cracking in any of the chloride salts and has excellent resistance to all of the non-oxidizing halides. Oxidizing acid chlorides such as ferric, cupric and mercuric are very corrosive and should be used in low concentrations. Stannic chloride is less strongly oxidizing, and dilute solutions at atmospheric temperature are resisted. The maximum safe limit in oxidizing alkaline chlorides is 500 ppm available chlorine for continuous exposure. In bleaching, sodium silicate (1.4 specific gravity) can be used as an inhibitor to corrosion; as little as 0.5ml/liter of bleach has been found to be effective. Some very reactive and corrosive chlorides – phosphorus oxychloride, phosphorus trichloride, nitrosyl chloride, benzyl chloride and benzoyl chloride – are commonly contained in Nickel 201.
It has excellent resistance to neutral and alkaline salt solutions.

Fluorine and chlorine

In comparison with other commercial metals and alloys, Nickel 201 has outstanding resistance to dry fluorine. Nickel 201 is the most practical for service in chlorine or hydrogen chloride at elevated temperatures.