

*** Name Origin:**

In December 2015, the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Pure and Applied Physics (IUPAP) recognized the element and assigned the priority of the discovery to RIKEN. In November 2016, the IUPAC published a declaration defining the name to be nihonium. The name comes from the common Japanese name for Japan (日本 nihon). On 28 November 2016, the name became official.

*** Sources:**

In the periodic table, it is a p-block transactinide element. It is a member of the 7th period and is placed in the boron group, although it has not been confirmed to behave as the heavier homologue to thallium in the boron group. Nihonium is calculated to have some similar properties to its lighter homologues, boron, aluminium, gallium, indium, and thallium, and behave as a post-transition metal, although it should also show several major differences from them. Unlike all the other p-block elements, it may be able to involve its d-electrons in bonding, although these predictions are disputed.

*** Uses:**

None

*** Additional Notes:**

The first report of Nihonium was in August 2003 when it was identified as a decay product of ununpentium. These results were published on February 1, 2004, by a team composed of Russian scientists at Dubna (Joint Institute for Nuclear Research), and American scientists at the Lawrence Livermore National Laboratory.

On July 23, 2004, a team of Japanese scientists at RIKEN detected a single atom of ^{278}Uut using the cold fusion reaction between bismuth-209 and zinc-70. They published their results on September 28, 2004.

Support for their claim appeared in 2004 when scientists at the Institute of Modern Physics (IMP) identified ^{266}Bh as decaying with identical properties to their single event (see bohrium).

The RIKEN team produced a further atom on April 2, 2005, although the decay data were different from the first chain, and may be due to the formation of a meta-stable isomer.

The Dubna-Livermore collaboration has strengthened their claim for the discovery of ununtrium by conducting chemical experiments on the decay daughter ^{268}Db . In experiments in June 2004 and December 2005, the dubnium isotope was successfully identified by milking the Db fraction and measuring any SF activities. Both the half-life and decay mode were confirmed for the proposed ^{268}Db which lends support to the assignment of $Z=115$ and $Z=113$ to the parent and daughter nuclei.

Theoretical estimates of alpha-decay half-lives of alpha-decay chains from element 113 are in good agreement with the experimental data.

* Predicted Properties:

Nihonium is the first member of the 7p series of elements and the heaviest group 13 element on the periodic table, below boron, aluminium, gallium, indium, and thallium. It is predicted to show many differences from its lighter homologues: a largely contributing effect is the spin-orbit (SO) interaction. It is especially strong for the superheavy elements, because their electrons move much faster than in lighter atoms, at velocities comparable to the speed of light. In relation to nihonium atoms, it lowers the 7s and the 7p electron energy levels (stabilizing the corresponding electrons), but two of the 7p electron energy levels are stabilized more than the other four. The stabilization of the 7s electrons is called the inert pair effect, and the effect "tearing" the 7p subshell into the more stabilized and the less stabilized parts is called the subshell splitting. Computation chemists see the split as a change of the second (azimuthal) quantum number l from 1 to $1/2$ and $3/2$ for the more stabilized and less stabilized parts of the 7p subshell, respectively. For many theoretical purposes, the valence electron configuration may be represented to reflect the 7p subshell split as $7s^2 7p_{1/2}^1 7p_{3/2}^1$. These effects stabilize lower oxidation states: the first ionization energy of nihonium is expected to be 7.306 eV, the highest in group 13. Hence, the most stable oxidation state of nihonium is predicted to be the +1 state, and nihonium is expected to be less reactive than thallium. Differences for other electron levels also exist. For example, the 6d electron levels (also split in halves, with four being $6d_{3/2}$ and six being $6d_{5/2}$) are both raised, so that they are close in energy to the 7s ones. Thus, the 6d electron levels, being destabilized, should still be able to participate in chemical reactions in nihonium (as well as in the next 7p element, flerovium), thus making it behave in some ways like transition metals and allow higher oxidation states. Nihonium should hence also be able to show stable +3 and possibly also +5 oxidation states. However, the +3 state should still be less stable than the +1 state, following periodic trends. Nihonium should be the most electronegative among all the group 13 elements: for example, in the compound NhTs, the negative charge is expected to be on the nihonium atom rather than the tennessine atom, the opposite of what would be expected from simple periodicity. The electron affinity of nihonium is calculated to be around 0.68 eV; in comparison, that of thallium is 0.4 eV. The high electron affinity and electronegativity of nihonium are due to it being only one electron short of the closed-shell valence electron configuration of flerovium ($7s^2 7p_{1/2}^2$): this would make the -1 oxidation state of nihonium more stable than that of its lighter congener thallium. The standard electrode potential for the Nh^+/Nh couple is predicted to be -0.6 V.

The simplest possible nihonium compound is the monohydride, NhH. The bonding is provided by the $7p_{1/2}$ electron of nihonium and the 1s electron of hydrogen. However, the SO interaction causes the binding energy of nihonium monohydride to be reduced by about 1 eV and the nihonium-hydrogen bond length to decrease as the bonding $7p_{1/2}$ orbital is relativistically contracted. This is exceptional in the 7p series of elements; all other MH ($M = \text{Fl}, \text{Mc}, \text{Lv}, \text{Ts}, \text{Og}$) molecules have relativistic expansion of the bond length instead of contraction. The analogous monofluoride (NhF) should also exist. Nihonium should also be able to form the trihydride (NhH₃), trifluoride (NhF₃), and trichloride (NhCl₃), with nihonium in the +3 oxidation state. Because the 6d electrons are involved in bonding instead of the 7s ones, these molecules are predicted to be T-

shaped and not trigonal planar. Although the polyfluoride anion NhF_6^- should be stable, the corresponding neutral fluoride NhF_5 should be unstable, spontaneously decomposing into the trifluoride and elemental fluorine. Nihonium(I) is predicted to be more similar to silver(I) than thallium(I): the Nh^+ ion is expected to more willingly bind anions, so that NhCl should be quite soluble in an excess of hydrochloric acid or in ammonia while TlCl is not. Additionally, in contrast to the strongly basic TlOH , nihonium(I) should instead form Nh_2O , which would be weakly water-soluble and readily ammonia-soluble. The adsorption behavior of nihonium on gold surfaces in thermochromatographical experiments is expected to be closer to that of astatine than that of thallium.

Nihonium is expected to be much denser than thallium, having a predicted density of about 16 to 18 g/cm^3 , due to the relativistic stabilization and contraction of its 7s and 7p $_{1/2}$ orbitals. This is because calculations estimate it to have an atomic radius of about 170 pm, the same as that of thallium, even though periodic trends would predict it to have an atomic radius larger than that of thallium due to it being one period further down in the periodic table. The melting and boiling points of nihonium are not definitely known, but have been calculated to be 430 °C and 1100 °C respectively, exceeding the values for gallium, indium, and thallium, following periodic trends.