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A TALE OF NINE NEW ELEMENTS

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ABSTRACT

Elements are the basic constituents of all types of matter. A chemical element is a pure chemical substance consisting of a single type of atom distinguished by its atomic number. The Discovery of chemical elements has been an ongoing process since ancient times. At present 118 elements are known. Out of these, recently discovered elements are synthetic, manmade and efforts are still going on to synthesis new elements by artificial transmutation. In this, I reviewed the basic information and properties of the Z=110 to 118 elements.

KEYWORDS: New elements, atomic number, Isotopes, radioactive elements.

INTRODUCTION

Chemistry plays a dominant role in the development of modern human societies over the entire globe. It has done so by virtue of the central position it has occupied in improving the health and nutrition of people.

Chemical elements are central for the existence of life and the richness and variety of our environment. Therefore, one of the basic questions concerns the origin of the chemical elements. The answer is complex because it relies on dynamical processes from elementary particles and nuclei to stars and galaxies. An interdisciplinary effort of various fields of science achieved considerable progress in this direction of research. The periodic table with new elements always a favourite among chemists. Therefore, the Periodic Table currently contains 118 elements, the lightest being hydrogen and the heaviest yet unnamed eka-radon (or Uuo,ununoctium).

110 (Darmastadium): Darmastadim (Ds) was first synthesized on 9th Nov, 1994 experiment by a multinational team of scientists working at the Heavy -Ion Research centre (GSI) in Darmstadt Germany.

$Pb^{208} + Ni^{62} \longrightarrow Ds^{26} + n$ ($t_{1/2}$ = 0.17 milli seconds)

$Pb^{208} + Ni^{64} \longrightarrow Ds^{271} + n$

The name derives from the city of 'Darmstandt' in Germany, where it was first synthesized. It has 8 isotopes whose half-lives are known, with mass number 267 to 281.

Isotope	Ds^{267}	Ds^{269}	Ds^{270}	Ds^{271}	Ds^{273}	Ds^{277}	Ds^{279}	Ds^{281}
$T_{1/2}$	2.8μs.	179μs	6.0 ms	1.63ms	170μs	5.7ms	0.18s	11s

111(Reontgenium): Reontgenium (Rg, Z=111) (1994) was discovered by the following reaction.

$Bi^{209} + Ni^{64} \longrightarrow Rg^{272} + {}_0n^1$

It has a most stable isotope Rg^{281} ($t_{1/2}$ =38 seconds). The name derives from the physicist Wilhelm Conrad Roentgen, who discovered X-rays in 1895 and who won the first noble prize in physics in 1905. It is a radioactive metal. From its position in the periodic table, in group 11 below gold. It has 7 isotopes.

Isotope	Rg^{274}	Rg^{278}	Rg^{279}	Rg^{280}	Rg^{281}	Rg^{282}
$T_{1/2}$	6.4ms.	4.2ms	0.17s	3.6sms	26s	0.5s

It is an extremely radioactive synthetic element. It is a d-block transactinde element based on the most stable oxidation states of the lighter group 11 elements, Rg is predicted to show stable +5, +3 and +1 oxidation states, with a less stable +1 state, and most stable state is +3.

112(Copernicium): Copernicium (Cn) was first synthesized on 9th Feb,1996 experiment by a multi -national team of scientists working at the Heavy-Ion Research centre (GSI) in Darmstadt, Germany. Its stable isotope is Cn^{285} ($t_{1/2}$ =29 seconds)

$Pb^{208} + Zn^{70} \longrightarrow Cn^{277} + {}_0n^1$

It is a d-block trans actinide element. It has been shown to be an extreamely volatile metal and group-12 element. The name derives from the Astronomer and mathematician Nicolus Copernicus, who postulated the helio centric theory that the earth orbits around the sun, contracting prior belief, to honour an outstanding scientist, who changed our view of the world. On 19 feb 2010, the 537th anniversary of copernicus birth, IUPAC officially accepted the proposed name and symbol. It has 5 isotopes whose half-lives are known, with mass number 275 to 285

Isotope	Cn^{277}	Cn^{281}	Cn^{282}	Cn^{283}	Cn^{284}	Cn^{285}
$T_{1/2}$	0.69ms.	97ms	0.8ms	4s	97ms	29sec.

113(Ununtrium)(Uut): It is also known a eka -thalium. (or) dvi-Indium it is a radio active synthetic element. It was first created in 2003 by the Joint Institute for nuclear Research in Dubne, Russia. It is a P-block trans actinide element.

$Am^{243} + Ca^{48} \longrightarrow Uup^{288} + 3{}_0n^1 \longrightarrow Uut^{284} + \alpha$

$Am^{243} + Ca^{48} \longrightarrow Uup^{287} + 4{}_0n^1 \longrightarrow Uut^{284} + \alpha$

On August 2012, Scientists at the RIKEN Nishina centre for Accelarator Based Scence in Japan, claimed to have synthesised 'element 113' by the following reaction.

$Bi^{209} + Zn^{70} \longrightarrow Uut^{278} + n$

If the discovery gets approved by the IUPAC/IUPAP joint working party, this will be the first time in history that a team of Asian physicists will get to name a new element.

Isotope	Uut^{278}	Uut^{282}	Uut^{283}	Uut^{284}	Uut^{285}	Uut^{286}
$T_{1/2}$	0.24ms.	70ms	0.10s	0.48s	5.5s	20s

114(Flerovium): Flerovium was first synthesized in December 1998 by a team of scientists at the Joint Institute for Nuclear Research (JINR) in Dubna, Russia led by Yuri Oganessian, who bombarded a target of plutonium-244 with accelerated nuclei of calcium-48:

$Pu^{244} + Ca^{48} \longrightarrow Fl^{292} + n$

Flerovium is the super heavy artificial chemical element with the symbol Fl and atomic number 114. It is an extremely radioactive element. The element is named after the Flerov Laboratory of Nuclear Reactions of the Joint Institute for Nuclear Research in Dubna, Russia, where the element was discovered in 1998. The name of the laboratory, in turn, honors the Russian physicist Georgy Flyorov. The name was adopted by IUPAC on May 30, 2012. It is a trans actinide element in the p-block. It is a member of the 7th period and is currently placed as the heaviest known member of the carbon group. Using Mendeleev's nomenclature for unnamed and undiscovered elements, flerovium is sometimes called *eka-lead*. IUPAC name is Ununquadium(Uuq).

Isotope	^{285}Fl	^{286}Fl	^{287}Fl	^{288}Fl	^{289}Fl
Year discovered	2010	2002	2002	2002	1999
Discovery reaction	^{242}Pu (^{48}Ca, 5n)	^{249}Cf (^{48}Ca, 3n)	^{244}Pu (^{48}Ca, 5n)	^{244}Pu (^{48}Ca, 4n)	^{244}Pu (^{48}Ca, 3n)

Four isotopes of element 114, with atomic numbers from 286 to 289, have been produced at a heavy-ion cyclotron from nuclear fusion reactions between ^{48}Ca ion beams and targets made of several isotopes of plutonium or curium. In 2011, the International Union of Pure and Applied Chemistry agreed to name element 114 after the Flerov Laboratory of Nuclear Reactions in Dubna, which itself took the name of its founder, Georgii Nikolajevich Flerov , a prominent Russian nuclear physicist and co-discoverer of spontaneous nuclear fission.

115(Ununpentium): On August 27, 2013, researchers at GSI from Lund University in Sweden reported confirming the existence of the 115 element. The IUPAC name is Ununpentium (Uup). It is a synthetic super heavy element. On February 2, 2004, synthesis of ununpentium was reported in Physical Review by a team composed of Russian scientists at the Joint Institute for Nuclear Research in Dubna, and American scientists at the Lawrence Livermore National Laboratory.

$Ca^{48} + Am^{243} \longrightarrow Uup^{*291} \rightarrow Uup^{288} + 3\ n$

Ununpentium is known as eka-bismuth. Ununpentium is a temporary IUPAC systematic element name derived from the digits 115, where "un-" represents Latin unum. "Pent-" represents the Greek word for 5.

Isotope	^{287}Uup	^{288}Uup	^{289}Uup	^{290}Uup
Year discovered	2003	2003	2009	2009
reaction	$^{243}Am(^{48}Ca,4n)$	$^{243}Am(^{48}Ca,3n)$	$^{243}Am(^{48}Ca,3n)$	$^{249}Bk(^{48}Ca,3n)$

116(Livermorium): Livermorium is the synthetic super heavy element with the symbol **Lv** and atomic number 116. The name was adopted by IUPAC on May 30, 2012. It is placed as the heaviest member of group 16 (VIA), although a sufficiently stable isotope is not known at this time to allow chemical experiments to confirm its position as a heavier homologue to polonium. On July 19, 2000, scientists at Dubna (JINR) detected a single decay from an atom of Livermorium following the irradiation of a Cm-248 target with Ca-48 ions.

$_{20}Ca^{48} + {}_{96}Cm^{248} \longrightarrow {}_{116}Lv^{293} + 3\ {}_{0}n^{1}$

Livermorium is known as eka-polonium. Its IUPAC name is Ununhexium(Uuh). Livermorium is projected to be the fourth member of the 7p series of non-metals and the heaviest member of group 16 (VIA) in the Periodic Table, below polonium.

Isotope	Lv^{290}	Lv^{291}	Lv^{292}	Lv^{293}
Year discovered	2002	2003	2004	2000
Discovery reaction	$^{249}Cf(^{48}Ca,3n)$	$^{245}Cm(^{48}Ca,2n)$	$^{248}Cm(^{48}Ca,4n)$	$^{248}Cm(^{48}Ca,3n)$

117(Ununseptium): In January 2010, scientists at the Flerov Laboratory of Nuclear Reactions announced internally that they had succeeded in detecting the decay of a new element with atomic number 117 via two decay chains of an odd-odd isotope (undergoing 6 alpha decays before undergoing spontaneous fission) and of an odd-even one (3 alpha decays before fission). On April 9, 2010 an official report was released in the journal Physical Review Letters.

$Bk^{249} + Ca^{48} \rightarrow Uus^{297*} \rightarrow Uus^{294} + 3\ {}_{0}n^{1}$ (1event)

$Bk^{249} + Ca^{48} \rightarrow Uus^{297*} \rightarrow Uus^{293} + 4\ {}_{0}n^{1}$ (5 events)

Ununseptium is the superheavy artificial chemical element with temporary symbol Uus and atomic number 117. The element, also known as eka-astatine.

118 (Ununoctium): In 1999, researchers at Lawrence Berkeley National Laboratory made use of these predictions and announced the discovery oflivermorium and ununoctium, in a paper published in Physical Review Letters, and very soon after the results were reported in Science. The researchers reported to have performed the reaction

$_{36}Kr^{86} + {}_{82}Pb^{208} \rightarrow {}_{118}Uuo^{293} + {}_{0}n^{1}$.

Ununoctium is the temporary IUPAC name for the transactinide element with the atomic number 118 and temporary element symbol Uuo. It is also known as eka-radon or element 118. It is a p-block element and the last one of the 7th period. ununoctium was known as eka-emanation (emanation is the old name for radon).

Table.1. Summary of the nine new elements

Atomic No (z)	Name	IUPAC Name	Symbol	Atomic Weight g/mol	Period	Group	Block	Year of Discovey	Discovered by
110	Darmstadtim	Ununnilium	Uun (Ds)	281	7th	10	d	9th Nov 1994	Peter Armbruster Gohtried munzenber and Co-workers.
111	Roentgenium	Unununium	Uuu (Rg)	281	7th	11	d	December 1994	Peter Armbruster Gohtried munzenber and Co-workers
112	Copernicium	Ununbium	Uub (Cn)	285	7th	12	d	9th Feb 1996	Team membrs of Heavy - Ion Research centre, Darms, Garmany
113		Ununtrium	Uut	286	7th	13	d	2003	JINRLLN LAB
114	Flerovium	Ununquadium	Uuq	289	7th	14	d	2003	JINRLLN LAB
115		Ununpentium	Uup	288	7th	15	d	2003	JINRLLN LAB
116	Livemorium	Ununhexium	Uuh	293	7th	16	d	2003	JINRLLN LAB
117		Ununseptium	Uus	294	7th	17	d	2010	JINRLLN LAB
118		Ununoctium	Uuo	294	7th	18	p	2002	JINRLLN LAB

CONCLUSION

The study of the chemical properties of the heaviest known elements in the Periodic Table is an extremely challenging task and requires the development of unique methods but also the persistence to continuously improve all the processes and components involved in order to achieve the ultimate goal of chemically isolating one single atom that lives for only a few seconds. At first sight, the study of the chemical properties of the heaviest elements appears to be of purely academic interest. Indeed, as of today, it is not conceivable that weighable quantities of any transactinide element will be produced in the near future, and their immediate practical use appears questionable. Nevertheless, chemical studies of the heaviest elements open up possibilities for a deeper insight into the regularities of the Mendeleev Periodic System. Recent experiments have demonstrated that the chemical properties of the heaviest elements can no longer be predicted from simple extrapolations of the regularities in the groups and periods of the Periodic Table.

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