

DETAILS OF HYDROGEN USE IN HEAVY GOODS VEHICLES

24.10.2023 ZERO EMISSION KNOWLEDGE

Agenda

1. Introduction Evert de Jong (ECTA)
2. - Legislation and Directives Adriaan van Hoeken (Lhyfe.com)
- Implications and Standards, incl. ISO 14083 Christophe Dubruque (Lhyfe.com)
- Hydrogen Use Cases in Transport
3. Q & A / Panel Adriaan van Hoeken (Lhyfe.com)
Christophe Dubruque (Lhyfe.com)
Luc Haesaerts (Haesaerts)
Evert de Jong (ECTA), moderator
4. Closing remarks Evert de Jong (ECTA)

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Meeting rules

1. Do's and don'ts – no commercial contents, reminder of EU Competition Law requirements
2. Because of the high number of participants, we request all (except for the speakers / panel members) to communicate via the chatbox of the meeting.
3. Please all mute your microphones and block your cameras to facilitate a smooth meeting and ensure the best connectivity during the meeting.

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Disclaimer

1. The documents referred to in this presentation (e.g. Standards, directives, and their derived documents) may be further developed/changed in the near future. You are advised to check with latest versions, final published documents to make sure you have to correct information to base your system on.
2. ECTA webinars have an advisory nature. We do not provide any solutions how to implement specifically in your own organization, nor can we take any responsibility for the choices you make.

DETAILS OF HYDROGEN USE IN HEAVY GOODS VEHICLES

Periodic Table of the Elements

Atomic Number → 1 ← Symbol
Name → Hydrogen ← Atomic Weight
Electrons per shell → 1

State of matter (color of name)
GAS LIQUID SOLID UNKNOWN

Subcategory in the metal-metalloid-nonmetal trend (color of background)
 Alkali metals, Alkaline earth metals, Transition metals, Lanthanides, Actinides, Post-transition metals, Metalloids, Reactive nonmetals, Noble gases, Unknown chemical properties

1 IA H Hydrogen 1.008 1																	18 VIIIA He Helium 4.0026 2																		
3 Li Lithium 6.94 2,1	4 IIA Be Beryllium 9.0122 2,2											5 IIIA B Boron 10.81 2,3	6 IVA C Carbon 12.011 2,4	7 VA N Nitrogen 14.007 2,5	8 VIA O Oxygen 15.999 2,6	9 VIIA F Fluorine 18.998 2,7	10 Ne Neon 20.180 2,8																		
11 Na Sodium 22.98976928 2,8,1	12 Mg Magnesium 24.304 2,8,2	13 Al Aluminum 26.9815385 2,8,3	14 Si Silicon 28.0855 2,8,4	15 P Phosphorus 30.973761998 2,8,5	16 S Sulfur 32.06 2,8,6	17 Cl Chlorine 35.45 2,8,7	18 Ar Argon 39.948 2,8,8	19 K Potassium 39.0983 2,8,8,1	20 Ca Calcium 40.078 2,8,8,2	21 Sc Scandium 44.955912 2,8,9,2	22 Ti Titanium 47.88 2,8,9,2	23 V Vanadium 50.9415 2,8,9,2	24 Cr Chromium 51.9961 2,8,9,2	25 Mn Manganese 54.938044 2,8,9,2	26 Fe Iron 55.845 2,8,9,2	27 Co Cobalt 58.933 2,8,9,2	28 Ni Nickel 58.693 2,8,9,2	29 Cu Copper 63.546 2,8,9,2	30 Zn Zinc 65.38 2,8,9,2	31 Ga Gallium 69.723 2,8,9,3	32 Ge Germanium 72.630 2,8,9,4	33 As Arsenic 74.9216 2,8,9,4	34 Se Selenium 78.971 2,8,9,4	35 Br Bromine 79.904 2,8,9,4	36 Kr Krypton 83.798 2,8,9,4										
37 Rb Rubidium 85.4678 2,8,18,6,1	38 Sr Strontium 87.62 2,8,18,6,2	39 Y Yttrium 88.90584 2,8,18,6,2	40 Zr Zirconium 91.224 2,8,18,6,2	41 Nb Niobium 92.90637 2,8,18,6,2	42 Mo Molybdenum 95.95 2,8,18,6,2	43 Tc Technetium (98) 2,8,18,6,2	44 Ru Ruthenium 101.07 2,8,18,6,2	45 Rh Rhodium 102.91 2,8,18,6,2	46 Pd Palladium 106.42 2,8,18,6,2	47 Ag Silver 107.87 2,8,18,6,2	48 Cd Cadmium 112.41 2,8,18,6,2	49 In Indium 114.82 2,8,18,6,2	50 Sn Tin 118.71 2,8,18,6,4	51 Sb Antimony 121.76 2,8,18,6,4	52 Te Tellurium 127.60 2,8,18,6,4	53 I Iodine 126.90 2,8,18,6,4	54 Xe Xenon 131.29 2,8,18,6,4	55 Cs Cesium 132.90545196 2,8,18,6,4,1	56 Ba Barium 137.327 2,8,18,6,4,2	57-71 Lanthanides	72 Hf Hafnium 178.49 2,8,18,32,6,2	73 Ta Tantalum 180.94788 2,8,18,32,6,2	74 W Tungsten 183.84 2,8,18,32,6,2	75 Re Rhenium 186.21 2,8,18,32,6,2	76 Os Osmium 190.23 2,8,18,32,6,2	77 Ir Iridium 192.22 2,8,18,32,6,2	78 Pt Platinum 195.08 2,8,18,32,6,2	79 Au Gold 196.97 2,8,18,32,6,2	80 Hg Mercury 200.59 2,8,18,32,6,2	81 Tl Thallium 204.38 2,8,18,32,6,3	82 Pb Lead 207.2 2,8,18,32,6,4	83 Bi Bismuth 208.98 2,8,18,32,6,5	84 Po Polonium 209 2,8,18,32,6,4	85 At Astatine (210) 2,8,18,32,6,7	86 Rn Radon (222) 2,8,18,32,6,8
87 Fr Francium (223) 2,8,18,32,6,8,1	88 Ra Radium (226) 2,8,18,32,6,8,2	89-103 Actinides	104 Rf Rutherfordium (261) 2,8,18,32,6,8,2	105 Db Dubnium (262) 2,8,18,32,6,8,2	106 Sg Seaborgium (263) 2,8,18,32,6,8,2	107 Bh Bohrium (264) 2,8,18,32,6,8,2	108 Hs Hassium (265) 2,8,18,32,6,8,2	109 Mt Meitnerium (266) 2,8,18,32,6,8,2	110 Ds Darmstadtium (268) 2,8,18,32,6,8,2	111 Rg Roentgenium (269) 2,8,18,32,6,8,2	112 Cn Copernicium (284) 2,8,18,32,6,8,2	113 Nh Nihonium (285) 2,8,18,32,6,8,2	114 Fl Flerovium (289) 2,8,18,32,6,8,4	115 Mc Moscovium (290) 2,8,18,32,6,8,4	116 Lv Livermorium (293) 2,8,18,32,6,8,4	117 Ts Tennessine (294) 2,8,18,32,6,8,4	118 Og Oganesson (294) 2,8,18,32,6,8,4																		
57 La Lanthanum 138.905 2,8,18,32,6,2	58 Ce Cerium 140.12 2,8,18,32,6,2	59 Pr Praseodymium 140.90766 2,8,18,32,6,2	60 Nd Neodymium 144.24 2,8,18,32,6,2	61 Pm Promethium (145) 2,8,18,32,6,2	62 Sm Samarium 150.36 2,8,18,32,6,2	63 Eu Europium 151.96 2,8,18,32,6,2	64 Gd Gadolinium 157.25 2,8,18,32,6,2	65 Tb Terbium 158.93 2,8,18,32,6,2	66 Dy Dysprosium 162.50 2,8,18,32,6,2	67 Ho Holmium 164.93 2,8,18,32,6,2	68 Er Erbium 167.26 2,8,18,32,6,2	69 Tm Thulium 168.93 2,8,18,32,6,2	70 Yb Ytterbium 173.05 2,8,18,32,6,2	71 Lu Lutetium 174.97 2,8,18,32,6,2																					
89 Ac Actinium (227) 2,8,18,32,6,8,2	90 Th Thorium 232.04 2,8,18,32,6,8,2	91 Pa Protactinium 231.04 2,8,18,32,6,8,2	92 U Uranium 238.03 2,8,18,32,6,8,2	93 Np Neptunium (237) 2,8,18,32,6,8,2	94 Pu Plutonium (244) 2,8,18,32,6,8,2	95 Am Americium (243) 2,8,18,32,6,8,2	96 Cm Curium (247) 2,8,18,32,6,8,2	97 Bk Berkelium (247) 2,8,18,32,6,8,2	98 Cf Californium (251) 2,8,18,32,6,8,2	99 Es Einsteinium (252) 2,8,18,32,6,8,2	100 Fm Fermium (257) 2,8,18,32,6,8,2	101 Md Mendelevium (258) 2,8,18,32,6,8,2	102 No Nobelium (259) 2,8,18,32,6,8,2	103 Lr Lawrencium (260) 2,8,18,32,6,8,2																					

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THE COLORS OF HYDROGEN

GREEN

Hydrogen produced by electrolysis of water, using electricity from renewable sources like wind or solar. Zero CO₂ emissions are produced.

BLUE

Hydrogen produced from fossil fuels (i.e., grey, black, or brown hydrogen) where CO₂ is captured and either stored or repurposed.

GREY

Hydrogen extracted from natural gas using steam-methane reforming. This is the most common form of hydrogen production in the world today.

PURPLE/PINK

Hydrogen produced by electrolysis using nuclear power.

TURQUOISE

Hydrogen produced by thermal splitting of methane (methane pyrolysis). Instead of CO₂, solid carbon is produced.

BROWN/BLACK

Hydrogen extracted from coal using gasification.

YELLOW

Hydrogen produced by electrolysis using grid electricity from various sources (i.e., renewables and fossil fuels).

WHITE

Hydrogen produced as a byproduct of industrial processes. Also refers to hydrogen occurring in its (rare) natural form.

<https://aeclinic.org/aec-blog/2021/6/24/the-colors-of-hydrogen>



DETAILS OF HYDROGEN USE IN HEAVY GOODS VEHICLES

Presentation

- Legislation and Directives
- Implications and Standards, incl. ISO 14083
- Hydrogen Use Cases in Transport

by Adriaan van Hoeken (Lhyfe)
Christophe Dubruque (Lhyfe)

DETAILS OF HYDROGEN USE IN HEAVY GOODS VEHICLES

Q & A

with Adriaan van Hoeken (Lhyfe)
Christophe Dubruque (Lhyfe)
Luc Haesarts (Haesaerts)
Evert de Jong (ECTA) - moderator

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Thanks for your participation in this webinar.

May I also bring to your attention:

➤ Please share your remaining questions also at our

ZERO EMISSION KNOWLEDGE PLATFORM **FORUM**

➤ **Our Annual Meeting in Dusseldorf on 16 Nov. 2023**

registration: <https://ecta.com/product/ecta-annual-meeting-2023/>

