

Miniature HHO electrolyser torch for work on jewelry and quartz optical fibers

By Janis Alnis 2017.09.

In $H_2 + O_2$ combustion temperatures up to $2800\text{ }^\circ\text{C}$ are obtained and that is used in science for melting of pure materials because there is no contamination with soot.

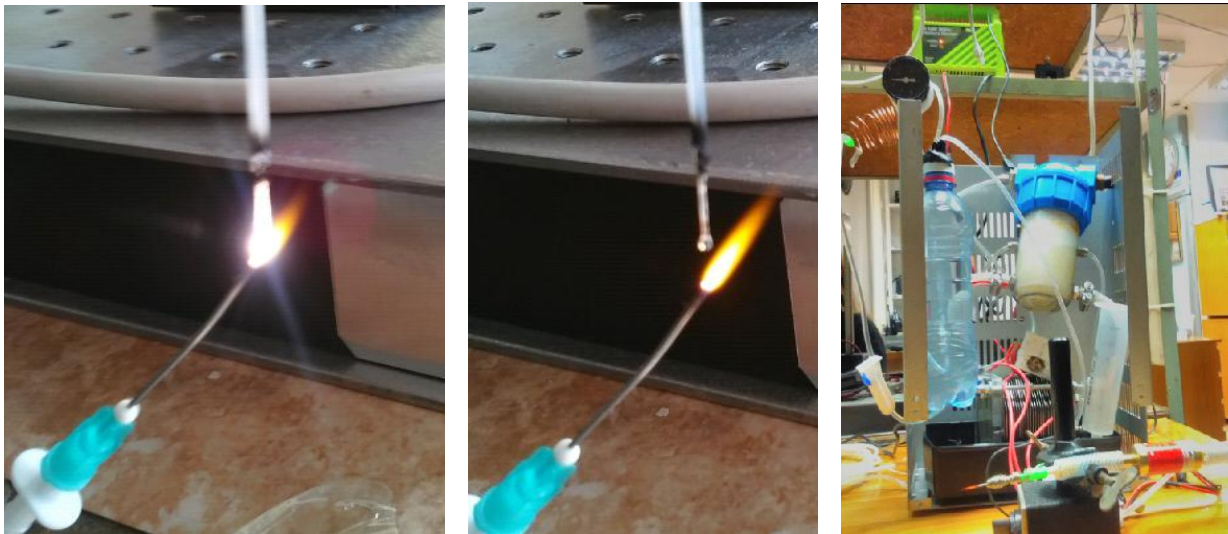
There are commercial devices around used in jewelry and car repairs. Nice video about the benefits of using a hydrogen torch: <https://www.youtube.com/watch?v=x07QDamYuec>

In the present instructable H_2 and O_2 gas mixture is obtained by water electrolysis. It is an explosive mixture and should be immediately burned. A bubbler and flame arrestor should be used. How explosive it is can be checked by filling just a few small soap bubbles in a plastic water cup and igniting them.

Video of the flame obtained in this instructable:

<https://youtu.be/DKZdzX-NbnA>

Picture below shows melting one end of a 500 micron OD optical fiber made from fused silica. At these high temperatures the fiber end shines bright white color. It was possible to melt through thin metal sheets like razor blades. Welding of copper transformer wires was not successful as it requires more powerful flame.



Test of electrolyser module

Electrolyser module was bought from Ebay "HYDROGEN GENERATOR HHO 21 PLATE DRY CELL" for 75 EUR. KOH solution in distilled water was used. The optimal cell voltage is 2 Volts and so 6 cells are connected in series to run from 12 V, and 4 groups are in parallel to increase production. Taking 12 V from a PC power supply caused it to shut down. Suitable option was a 12 V car battery charger rated at 4 Amps. The simplest setup is pictured below.



Bubbler

A 0.5 liter plastic water bottle was used as a bubbler to stop flashbacks. The cap has two holes for 4mm tubing sealed with hot-melt glue. One of the tubes goes way down to the bottom. Bubbler is filled with water almost to the top so that the exploding volume is small. Nevertheless the bubbler vessel jumps up with a loud pop. Explosions are quite severe. Sometimes plastic tubes rupture. Fire is seen inside the tubes. Hydrogen burning heat energy is so large that water vapor gets heated-up to high pressure. Smaller tubes store less gas volume for explosion. A test can be done by filling a few small soap bubbles and igniting them. Safest way would be to generate pure hydrogen using a membrane separator for 200EUR from (<http://hho.prom.ua>).

Flame

Medical 4 mm tubes were salvaged from intravenous infusion system bought at drugs store. For the burner needles with outer diameter of 0.4, 0.6, 0.8 mm were tried. The speed of exiting gas has to exceed the speed of gas burning (~30 m/s) otherwise the flashback will occur. Sometimes needles get hot causing the plastic to melt and a wire mantle was wound on the needle to dissipate the heat. Best way to extinguish the flame was to put the needle into a cup with water.



Construction of a permanent setup

After a week or so an extra vessel appeared to be necessary to avoid soap bubbles from entering the output line. Soap forms by dissolving of rubber seals and plastics. An enclosure from a 5" water filter was used. It is also holding extra electrolyte that is slowly used up.

Thick walls of the water filter enclosure allow to drill and tap holes for 1/4" and 1/8" thread diameter fittings. Threads were permanently sealed with anaerobic sealant. To cycle electrolyte bubbles efficiently 8 mm ID diameter plastic tubes were used.

Where just the the gas flows, a 4mm OD tubing with 1/8" fittings was used. An extra port was made where the water could be replenished with a syringe.

Anaerobic sealant was applied to the connections. Tightness was checked in a bucket with water. Soap bubble solution applied with a brush was used to check for leaks in assembled setup.

push connectors



medical 4 mm OD tubing



Parts can be bought at the local pneumatics shops and on Ebay:

- 4mm Push Fit x 1/8" NPT Male Stud Elbow Pneumatic Air Line Fitting KEL
- 4mm OD x 1/8" Metric BSPT Male Stud Pneumatic Push In Fittings
- 1/8" and 1/4" NPT Taps Hardened Tungsten Steel
- Boiler Safety Pressure Relief Valve. 1/2" BSP Choose 1.5 BAR
- Flashback arrestor valve for acetylene produces ca 0.1 bar pressure drop on it.

Bubbler was made of 32 mm diameter plastic pipes with melted end cups and a piece of transparent water hose.

A 1.5 bar safety valve used for water heating systems was installed on the top of the bubbler to release pressure during possible flashback as seen in some youtube videos. A commercial acetylene flashback arrestor valve was placed directly before the needle.

Flame arrestor valve



1.5 bar safety release valve



Ideas for future implementations

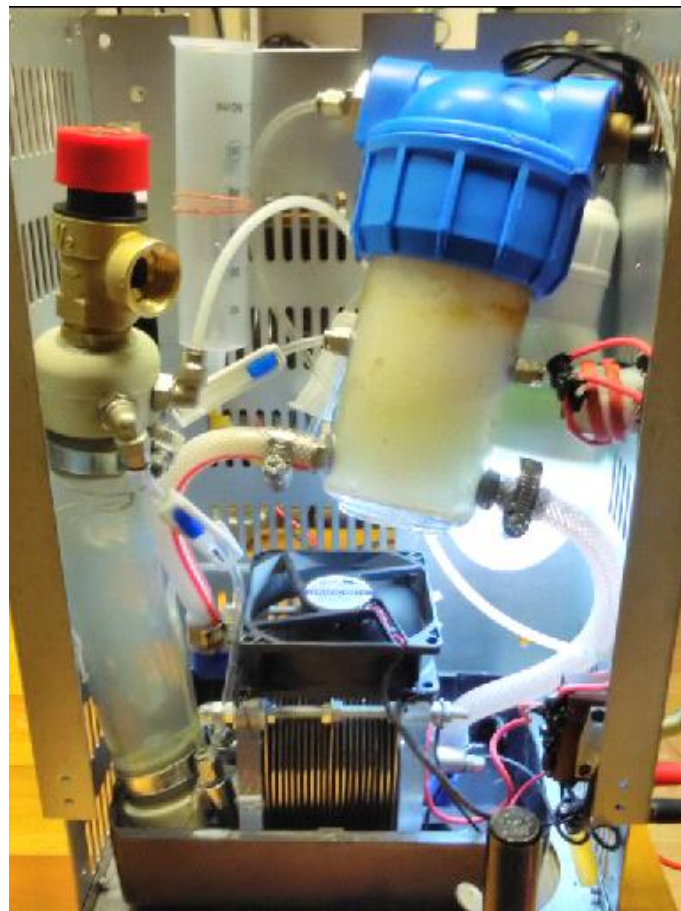
2" plastic pipes with screw connections as seen in many Youtube videos were not found in local hardware shop. May be drain water pipes can be used instead.

An extra water filter enclosure with a dryer filter can be used to clean up the exiting gas from KOH vapor that could be potentially corrosive. Test can be done by checking water produced after burning with a pH indicator paper.

Another feature would be to add electromechanical pressure relay like used in air compressors to cut the current. For example from Ebay "AC 250V 1/4" Port Air Compressor Automatic Pressure Switch 1-5 Bar". A gas flow meter can be installed electronic or floating ball type.



Final assembly



A 2.5 bar max pressure gauge was used allowing to monitor if the system is airtight.

A metal casing with a plenty of holes was built around the electrolyser to contain things inside during a potential explosion. On the bottom of the case was a plastic tray to accommodate eventual spills. An old PC fan cools the cell to reduce evaporation. LEDs allow to better see what's happening inside.

The 220V to 12V battery charger was placed at a safe distance. On the electrolyser enclosure side wall was a power ON/OFF switch and banana connectors from the charger. Current was monitored by an analog meter measuring the drop voltage across ca 20 cm piece of wire.

Outlook

Hydrogen is becoming increasingly popular as a fuel. Hydrogen admixture during combustions helps to start engine in cold weather and engine can run on hydrogen indoors. Hydrogen is believed to improve the velocity of combustion leading to slightly higher gasoline combustion efficiency, cleans the engine from soot and allows easier start in cold weather, while disadvantages are electrolyte freezing and carburetor explosion risk. Storing clean hydrogen in propane balloons becomes an increasingly popular alternative to batteries in photovoltaic systems. There is some medical interest to saturate drinking water with hydrogen that will make its electrochemical potential negative like that of the blood and body does not need to spend energy to convert it.

Links

Video of this instructable

<https://youtu.be/DKZdzX-NbnA>

Benefits of Using a Hydrogen Torch

<https://www.youtube.com/watch?v=x07QDamYuec>

HHO Generator - Water to Fuel Converter

<https://www.youtube.com/watch?v=cqjn3mup1So>

Hhoconnection

https://www.youtube.com/watch?v=OmXHHVh_nkY&index=4&list=PL22AF837F363BEE86

Homemade hydrogen generator and compressor unit

<https://www.youtube.com/watch?v=REV739pRNCw&t=494s>

The DIY Science Guy

<https://www.youtube.com/watch?v=REV739pRNCw>

Safely Making, Storing and Dispensing Hydrogen

<https://www.youtube.com/watch?v=g32BLZssoNo&t=1305s>

H2-13B2

<https://hho.prom.ua/p262202570-generator-chistogo-vodoroda.html>

Чистый водород сделай сам!!! /separate hydrogen and oxygen

<https://www.youtube.com/watch?v=jo-sTeahQ9g>

ННО Водородный сварочный аппарат 18-20л/мин

https://www.youtube.com/watch?v=B3TI3G_YtA8

STAR-1000 Отопление Водородом 20 батарей.

<https://www.youtube.com/watch?v=nLuK8s1Wjfl>

Hydrogen on demand conversion kit. Turn any car into a Hybrid for only a few hundred dollars.

<https://www.youtube.com/watch?v=WMiVdxBT0GI&t=9s>

Assemble and Wire ER50 Brown's Gas (BG or HHO) Electrolyzer from Kit (upgraded)

<https://www.youtube.com/watch?v=obpBHOjfrBA>

A RESEARCH ORGANIZATION THAT DEVELOPS & DISTRIBUTES PRACTICAL ENERGY-SAVING METHODS & DEVICE

<http://www.eagle-research.com/cms/store/browns-gas/er50-assembled-mini-browns-gas-electrolyzer>

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