



KEMP SINGAPORE PTE LTD

Pioneer and Leader in Alkaline Water Since 1988

Mesh Plate Technology

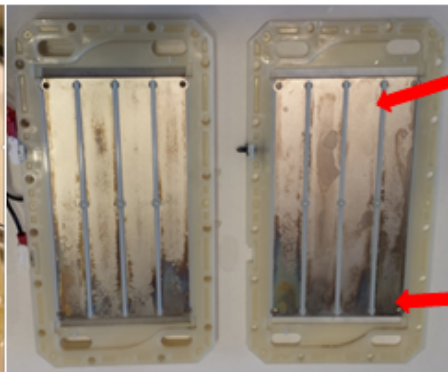
(Mesh Vs Solid Plate Technology)

Dr CL Yap

Disadvantages of Solid Plates (older technology)



Calcified Solid Plates



Burning Effect (Oxidation) to Expose Base Metal

Newer Mesh Technology



The advantages of Mesh Plate Technology

1. Electrolyte is fully immersed into mesh holes
2. Electrons travel more efficiently on edges
3. Energy efficient
4. Reduced generation of heat to prevent overheating
5. Increased dissipation of Hydrogen and Oxygen gasses
6. Better electrolyte flow
7. Electrodes cleaning process is safer without use of toxic chemicals which could be harmful Well Ventilated & No Burning Effect

Well Ventilated & No Burning Effect



KEMP SINGAPORE PTE LTD
Pioneer and Leader in Alkaline Water Since 1988

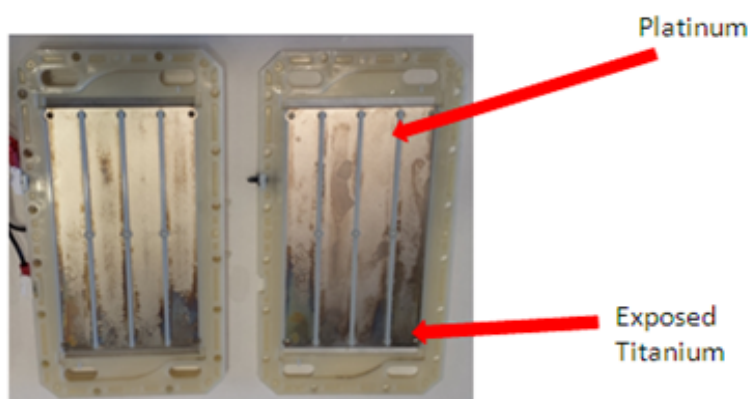
Copyright 2015. Kemp Trading. All rights reserved.

Calcification of Solid Plates



Calcification of solid plates often happens with low tech water ionizers without auto cleaning cycles. This buildup of calcium hinders electron flow and prevents proper ionization. In addition it contributes to the overheating of plates which can cause burnt or oxidized plates.

Burning Effect or Oxidation of Solid Plates



The principle of edge conductivity is well known as electrons travel better and faster along edges rather than flat surface.

This phenomenon happens often to water ionizers equipped with solid plates which provide minimum edge surface for electron travel. Electrons are forced to travel on the smooth surface of the plates, which hinders electrical transfer to the water. In order to overcome the resistance, ionizers with solid flat plates must provide extra power to the plates which cause a burning effect (or oxidation) on the plates. This explains why water ionizers with solid plates tend to have oxidized plates as shown above. If your water ionizer has solid plates without auto cleaning cycles, we recommend having your plates examined to make sure your plates are not burnt or oxidized. Oxidized plates with exposed subtract metal will

draw higher resistance, and hence higher power consumption, and it could lead to undesirable health issues.

Misinformation

There is a lot of **misinformation** in the ionized water industry regarding the relative merits of solid vs mesh electrolysis electrodes. Images of corroded or calcified mesh electrodes, as well as misleading information about the superiority of solid plates, can be seen on the websites of many water ionizer distributors. Many claimed that solid electrodes are more durable, have greater longevity, and simply last longer. It is often falsely claimed that solid electrodes are stronger and can withstand the high power needed to “ionize water”; whereas, the “flimsy” ‘mesh’ electrodes can quickly degrade and arguments such as a solid piece of metal can withstand more than a flimsy chain-link fence (although those solid electrodes are only about the thickness of a credit card, which one could also say is “flimsy”).

Fact

In reality, a properly designed mesh electrode for electrolysis of water may not only last longer, but is well known in the industries to be the most effective. Indeed, medical applications and mass production of hydrogen gas, oxygen gas, generation of chlorine/hypochlorous acid, as well as the production of sodium hydroxide, hydrogen peroxide and even processes in our bodies, all use and focus on a mesh type design. The reason is because a mesh design is far more efficient with lower resistance (less heat resulting in less oxidation or degradation) compared to solid electrodes. A scientific article by Sullivan, J. et al. shows below in comparing mesh plate to solid plate design that a higher current density can be achieved at the same applied voltage with mesh plate technology.

Channeling of Electron Flow

As solid electrodes have no way to organize or channel the current being delivered, there is an inconsistent saturation of electrons. Electrons will all move across the solid electrode to find the path of the least resistance. Generally, this would result in an inconsistent delivery of power and reduce efficiency of electrolysis. This is especially crucial to redox potential performance.

In contrast, mesh plates force the current to be organized by providing more “channeling” to direct the electron flow. The applied current evenly saturates the mesh-electrode, which increases surface area for electrolysis.

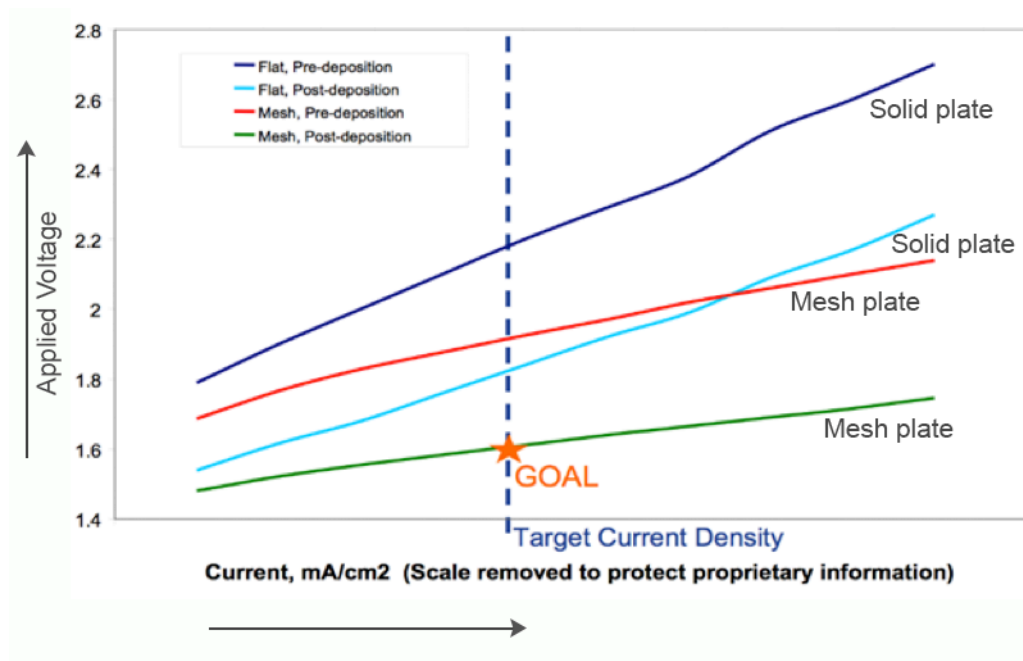
This has further been confirmed by a study conducted by Zhang, Merrill & Logan from Pennsylvania State University that **mesh plates** provide a higher surface area than flat plate electrodes...Cyclic voltammetry tests showed that the electrochemically active surface area of mesh plates could be **three times larger** than a solid flat sheet.



KEMP SINGAPORE PTE LTD
Pioneer and Leader in Alkaline Water Since 1988

Copyright 2015. Kemp Trading. All rights reserved.

The following graph validates the ability of mesh electrodes to achieve target current densities at lower applied voltages, therefore demonstrating their higher efficiency compared to solid electrodes:



As shown in the graph, mesh plates are more efficient than solid plates.

Electrons Travel Along Edges

As mentioned earlier, the principle of edge conductivity is well known as electrons travel better and faster along edges rather than flat surface.

Mesh plate increases edge surface area, and it conducts and distributes electrons more uniformly and more efficiently rather than flat surfaces. As the entire surface area of mesh plates act as energy distribution points, there is no concentration of energy to cause burning effect or oxidative corrosion as in solid plates. Hence it is more effective in maintaining pH, ORP and activated Hydrogen. Besides, it is evident that mesh technology creates better water flow.

Solid Plate Technology since 1832

Solid plate technology has been around since 1832. Since then, technology has been rapidly evolved. Mesh plate technology has been adopted to replace solid plates in many sensitive and high tech industries such as Medical, Water purification and others as stated in this article and references attached. Advanced technology calls for miniaturized and efficient technology. “Tanker technology” or solid plate is bulky and less efficient (consume more energy) and hence is out dated for these applications.



KEMP SINGAPORE PTE LTD
Pioneer and Leader in Alkaline Water Since 1988

Copyright 2015. Kemp Trading. All rights reserved.

Mesh plate technology is proven to be more superior than solid plates with following advantages:

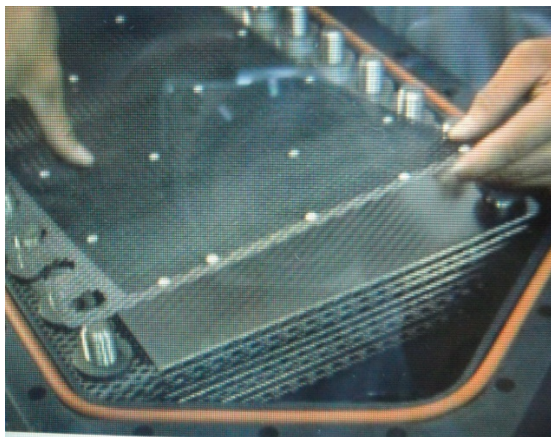
1. Electrolyte is fully immersed into mesh holes
2. Electrons travel more efficiently on edges
3. Energy efficient
4. Reduced heat generation to prevent overheating
5. Increased dissipation of Hydrogen and Oxygen gases
6. Better electrolyte flow
7. Electrodes cleaning process is safer without use of toxic chemicals which could be harmful.

Beware of Dangerous Chemicals!

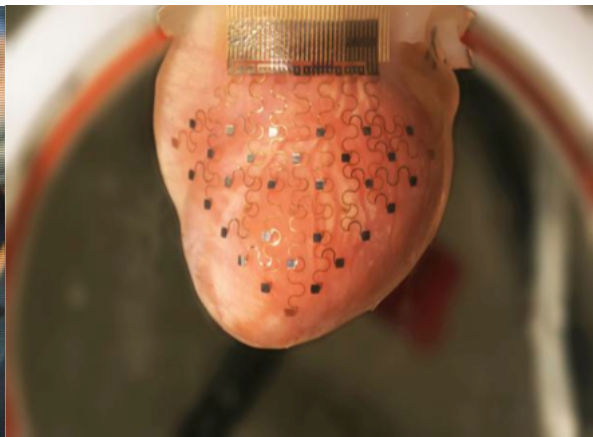
As mentioned, solid flat plate ionizers provide very little edge surface for electron travel. Electrons are forced to travel on the smooth surface of the plates, which hinders electron transfer to the water. In order to overcome the resistance of flat plates, ionizers with solid flat plates must provide extra power to the plates. It is evident that those water ionizers tend to consume more power than Mesh plated water ionizer. Another way which solid plate water ionizer overcomes the limitations of its solid flat plate technology is by requiring users to add **dangerous chemicals** to increase the conductivity in water to produce the required pH, ORP and Hydrogen. MESH equipped ionizers do not require chemical additives to produce acceptably high pH and –ORP levels.

Applications

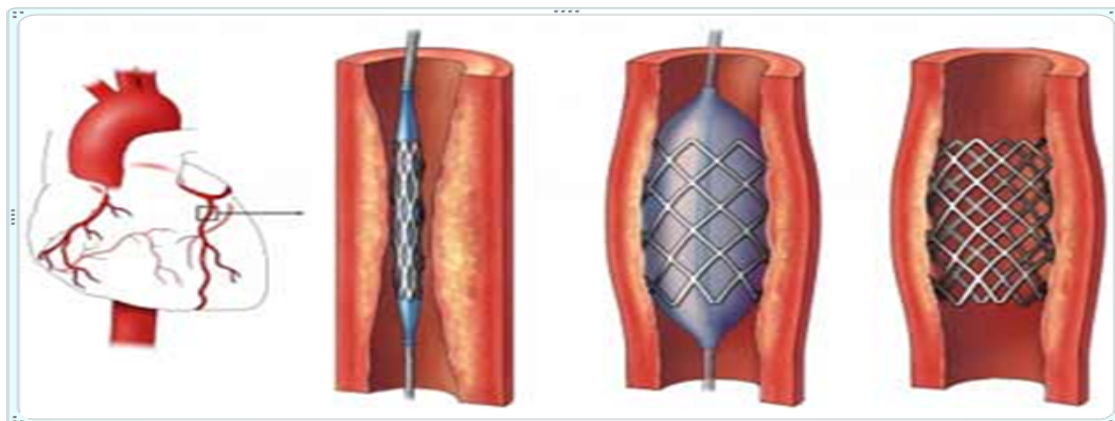
There are a few examples of high-tech applications of Platinum-Titanium MESH plate electrodes:



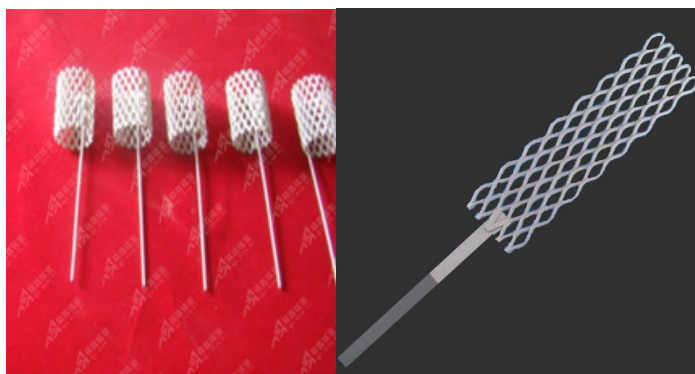
Water Purification System



Platinum-Titanium Mesh Electrode for Heart



Platinum-Titanium Mesh plate for blood vessels



Miniaturized Platinum-Titanium Electrodes for Medical Applications

Conclusion

Studies have shown that there is no inherent inferiority with a mesh-type electrolysis electrode, in fact many evidences show that mesh electrodes are widely favored to be used throughout various industries utilizing electrolytic processes especially in those medical and high-tech industries. Solid plate technology which is an older technology since 1832, and its applications are mainly favored in low cost and lower sensitive industries.

All Watercell plates in Kemp Singapore Water Ionizers are tested and verified by Singapore Government linked test lab, TUVPSB.

The following are some references which mention the use of mesh electrodes in various applications:

Stainless Steel Mesh used in the Photo-catalytic & Solar Production of Hydrogen Gas:

<http://www.sciencedirect.com/science/article/pii/S0360319914018874>http://www.imaps.org/abstracts/system/new/abstract_preview.asp?abstract=2014imaps063

Nickel Mesh used for Oxygen Production:

<http://link.springer.com/article/10.1007%2F978-94-007-1437-3>

Titanium Mesh used for Chlorine/Hypochlorous Acid Production:

http://www.severntrentdenora.com/Products-and-Services/Seawater-Electrochlorination-Systems/SANILEC/750_0040.pdf

Stainless Steel Mesh for the Production of Sodium Hydroxide:

<http://worldofchemicalsmedia.blogspot.com/2013/12/6-methods-used-in-sodium-hydroxide.html>

Titanium Mesh used in the Production of Hydrogen Peroxide:

<http://www.sciencedirect.com/science/article/pii/S0013468607004811>

In addition to the use of traditional mesh designs, other technologies, which are not flat, include gauze, mesoporous, and nano-tube configurations, which attest to the fact that “solid electrodes” are not some novel superior design:

Platinum Gauze:

<http://pubs.acs.org/doi/abs/10.1021/ac00284a079>

Mesoporous:

<http://pubs.acs.org/doi/abs/10.1021/jp808175d>

Nano-tube:

<http://www.sciencedirect.com/science/article/pii/S0360319910002375>

See also:

<https://books.google.com/books?id=a8HxCAAAQBAJ&pg=PA292&lpg=PA292&dq=industrial+electrolysis+of+brine+electrode+design&source=bl&ots=Jdu29m1m8d&sig=mC6FEW1jCvdN0sAzMd2aU1IhHMc&hl>



KEMP SINGAPORE PTE LTD
Pioneer and Leader in Alkaline Water Since 1988

Copyright 2015. Kemp Trading. All rights reserved.