Green Indicator

After a summer mostly filled with rain in the Nordic countries, both literally and figuratively, the Green Indicator is back with its August issue. In this issue we will discuss the increasing energy need in the world and its impact on the water requirement, both in terms of quantity and quality. We will also discuss the use of tailored surfaces as catalysts and use the fuel electrode assembly as an example as proposed by researchers at Yale University.

/ Christian Hulteberg

Water vs. Energy

With the energy consumption in the world increasing, other resources are becoming strained as well. There is an ever increasing need in the developing world for clean water, for drinking and irrigation purposes. The choice of energy production will have a significant impact on the amount of water that is required for producing the energy required, also impacting the water available for other applications. The power sources that uses the most water is geothermal energy, consuming about 11 metric tons of water per MWh produced; other highly water intense power sources are hydroelectric (5.5 ton/MWh), solar thermal (4 tons/MWh), nuclear (1.5-2.7 ton/MWh) as well as coal and biomass based electricity production (1.5 ton/MWh). In the other end of the spectrum we have natural gas based production with (0.5 tons/MWh), photovoltaic (0.1 tons/MWh) and wind (0.01 tons/MWh), all according to the US dept of energy.

The majority of the water requirement for thermal cycle plants such as nuclear, coal, natural gas and solar thermal comes with the use of cooling tower make-up. This make-up water can be

Green Indicator #14, August 2011

Tailored Catalysts

One of the key issues in tailoring catalyst surfaces for achieving high activity and selectivity with respect to the desired reaction is dispersion of the active phase. This is traditionally done by using a catalyst support with high surface area upon which the active phase is scattered using means of impregnation, deposition, sputting or other chemical means. However with new advances especially in the field of nanotechnology, it is possible to build tailored surfaces from scratch.

This is something that researchers at Yale University have taken as a basis for creating a new class of catalysts for use in fuel cells. The use of so called bulk-metal glass (BMG): "Amorphous metals such as BMGs are really nothing more than extremely slow-flowing liquids. This makes them unique among metals, and permits us to process them like plastics" (Jan Schroers, Nature 457, 762) allows for creating high surface area tailored surfaces with good dispersion of the active phase. In addition to giving the active phase good dispersion, the BGM is a better electric conductor than the traditional carbon fuel cell support. The resulting system also shows better longevity

such as lake or sea water or indeed gray-water should be considered; however in considering these alternatives, the environmental impacts should also be taken into account. However, the different power sources does not only impact the water quantity required, but also the water quality.

The extraction and production of energy for instance will impact the surrounding environment. In the case of oil and gas exploration, water is used for drilling and fracturing which may impact groundwater quality. The same can be said in the case of the impaired water in oil and gas or the water generated during mining operation; it to can impact groundwater and surface water. Also the production of energy with its emission of NOx, SOx, HC and CO as well as thermal emissions impact surface waters, ecology and lead to acidification. Finally the refining and processing of fuels as well as the transportation and storage of energy will lead to water consumption and impacts in water quality.

It is therefore imperative that the scientific and engineering community both take the water requirement into account, given the local conditions, when constructing or refurbishes a plant; but also continues to do research and development of improving and inventing new methods of water purification.

nature of the system, avoiding sintering.

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