Chlor-alkali for electronics and energy

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A chemistry for a digital world

Chlor-alkali chemistry plays a key role in many modern electronics. It also helps in the manufacture of materials to safely produce electricity and ensure that energy is used efficiently. Chlor-alkali is also found in many technologies to safely and efficiently recycle electronics and recover valuable materials for a more sustainable Europe.

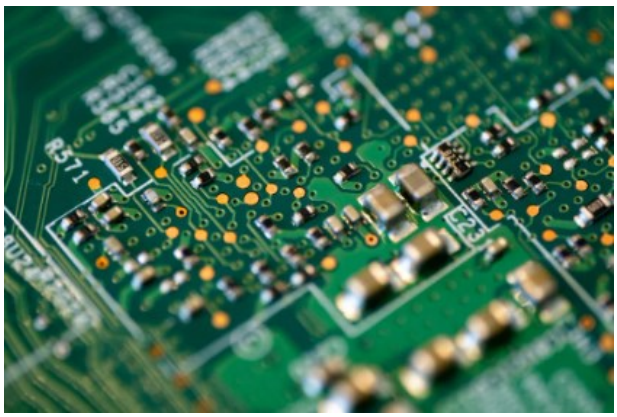
More than just clean and healthy water

Many people associate chlorine with the production of safe, clean drinking water or with healthy pools. However this important chemical, along with its co-products caustic soda, caustic potash and hydrogen (all together known as 'chlor-alkali'), plays an even wider role in society; for example in chemicals and materials for electronics and energy.

A key component in modern electronics...

One of the derived chlorine chemicals is hydrochloric acid (HCl). A familiar part of any school laboratory, HCl also has an important function in the production of microchips; the 'brain' of mobile phones, tablets, computers, drones and more. HCl is used to purify the silica, a material made from sand, which is the foundation of microchips.

Chlor-alkali chemistry helps to purify silicon for microchips in modern electronics



Chlorine chemicals are also found in fibre optics. These are found in cables that can carry messages (such as phone and internet signals) around the planet and are being increasingly used to deliver high-speed internet into your home. Neodymium trichloride is a key part of some of these cables.

Sodium hydroxide, another important chlor-alkali chemical, plays an important role in the extraction of aluminium from bauxite ore. This aluminium has many functions in electronics including low energy LED lighting and in power lines.

...and for their responsible end of life handling.

The UN Environment Programme (UNEP) estimates that, globally, over 50 million tonnes of electronic waste is generated every year. Not only should this waste be carefully handled but it is also a rich source of metals which are used in some of the electronic parts. Metals such as gold, copper, silver, zinc and platinum and more are found in these wastes. According to the World Economic Forum, 7% of all the gold in the world is currently held in electronics and US data further suggests that $60mn of gold and silver are disposed of each year in waste mobile phones alone.

As only 20% of these electronic wastes are recycled each year, tools to capture more of these materials need to be found. Chlor-alkali chemistry can play a role here. Sodium hydroxide can be used to remove the coatings on waste circuit boards as well as to recover some of the metals contained in these tiny 'gold mines'.

The metals recovered by these processes are of such high quality that the medals at the 2020 Tokyo Olympics were all made from precious metals recovered from waste electronics.

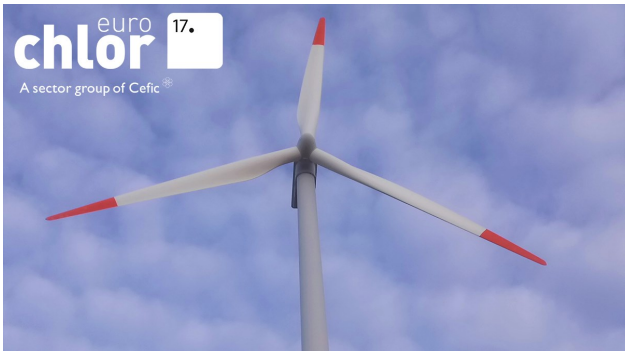
Image source: The Associated Press

Chlor-alkali for energy 'production' and use...

As Europe searches for climate-neutral solutions to produce its energy, it also needs innovative materials to help in the equipment to harness wind, wave and solar power. Many chlor-alkali materials are used in such renewable energy equipment.

One such material is epoxy resin. Since the 1980s, epoxy resins have been used in wind turbines; mostly in the composites and adhesives in rotor blades and other structural parts. Epoxy resins use epichlorohydrin, an important chlorine-containing chemical, in the first step of their production process. These resins are strong but lightweight making them ideal for wind turbines. Their use has enabled rotor blades to become 10 times longer in just a few decades to collect even more energy.

Windmills are made strong and lightweight thanks to chlor-alkali chemistry



Another renewable energy technology is solar power. Whilst lots of materials make up the panels which collect sunlight and convert it into usable energy, chlor-alkali materials also play a role. HCl again helps purify silica in these panels. This helps to make silicon that can be easily arranged into a lattice to make the collection of solar energy more efficient.

Another component in solar panels is titanium dioxide. This material can absorb UV from sunlight and turn it into electrical current. To get titanium dioxide, titanium-containing ores are treated with chlorine to give titanium tetrachloride. This is a liquid which can be purified and then treated with oxygen to make high-purity titanium dioxide and chlorine.

This chlorine can then be recycled back to purify even more titanium ore.

Chlor-alkali chemistry also helps us to use energy more efficiently. Polyurethane is a modern polymer which, whilst not containing chlorine, can use chlorine chemistry in the first step of their production by reacting carbon monoxide with chlorine gas. This material is one of the major users of chlorine (about 1/3 of European production) and is found in insulation to reduce heat loss from buildings and refrigerators.

...and important energy resource for the future?

Another key product from chlor-alkali is hydrogen. All chlor-alkali starts from salt and water. When an electrical current passes through these during chlor-alkali production the salt is split into two, but the water (H_2O) is also split generating hydrogen.

Europe has big plans for this important gas as a raw material in chemical and steel production but also in powering vehicles, heating buildings and maybe even as an energy source for communities. There are already ships and buses today which are being run on hydrogen from chlor-alkali production! Hydrogen from chlor-alkali is high purity, available across Europe and, when made using renewable or low-carbon energy, can even be considered 'green'.

Assuming that various practical and economic barriers can be addressed by authorities, Euro Chlor is working to ensure that all of its hydrogen is used. Additionally, given the experience of our industry in safely working with this potentially explosive gas, European chlor-alkali may play a role in kick-starting the continent's new hydrogen economy.

Read more about chlor-alkali at www.eurochlor.org.

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