Energypolis: Chemistry for Energy

Chemistry for Energy will be the main theme of the research to be carried out in the first building of the new EPFL campus in Valais. The current issue highlights the research of the different groups that will have their laboratory in Rue de l'Industrie 17 in Sion.

The availability of sufficient energy is one of the most important factors in a modern economy. For many years the rate of discovery of new reserves of cheap fossil fuels by oil and gas companies exceeded our use of the fuels, and as a consequence of this easy access to these fuels the world now depends for 80% on the use of fossil fuels. Burning these fossil fuels has increased the CO_2 concentration in our atmosphere to unacceptably high levels. This has created one of the biggest challenges of our times – securing our growing energy demands while reducing CO_2 emissions to zero. Most scientists agree that a silver bullet, a single technology that will solve all problems, does not exist. So we have to rely on a combination of different technologies that each contribute to part of the solution. This 'all of the above' strategy for energy research can also be seen in this special issue of CHIMIA.

The amount of energy we are using is a tiny fraction of all the energy that is arriving from the sun. If we are more efficient in harvesting this energy, we can reduce our dependence on fossil fuels. ***Professor Nazeeruddin and coworkers*** discuss the different materials that are involved in photovoltaic technology, such as dye-sensitized solar cells or perovskite solar cells. This field is a true strength of EPFL and we expect to see the group of Nazeeruddin pushing the boundaries further.

There is no question that we see a further increase of the use of solar energy. One of the disadvantages, however, is its intermittency; the differences between night and day need to be addressed, for example, by improving the way we can store energy. In Switzerland a popular way of storing energy is to use the existing hydro installations. By pumping water uphill one can store energy efficiently. However, not all countries have mountains close by and we also need fuels for transportation. Therefore an important line of research in Sion focuses on how chemistry can help us to develop better storage in the form of batteries or liquid fuels.

The group of ***Professor Girault*** is developing redox flow batteries to store energy. Such batteries can greatly benefit from improved technologies to make membrane electrode assemblies. An exciting idea is described in the first contribution of the group of Girault, which is the use of an inkjet printer to make such electrodes.

An attractive alternative energy carrier is H_2; unlike carbon, burning hydrogen only gives us water and no CO_2. However, compared to fossil fuels it is difficult to store H_2 with a sufficiently high energy density. ***Professor Züttel and co-workers*** focus on novel materials to store hydrogen.

Given that we are still using a significant amount of fossil fuels, it is important to develop technologies to deal with the CO_2 emissions. One way to reduce CO_2 emission is to capture the CO_2 from flue gasses. Subsequently one can store the CO_2 in geological formations, or if there is abundant solar energy, upgrade the CO_2 to a fuel or use it as a carbon source for chemicals. Such processes are illustrated in the second contribution of the group of ***Züttel***. The capture of CO_2, however, can be expensive. ***Dr. Stylianou and Professor Queen*** focus on developing new materials that reduce the cost of carbon capture. In parallel, ***Professor Smit*** is developing computational methods to screen different classes of materials for their potential to capture CO_2.

The research in Sion is not limited to energy, as is illustrated by the second article from the group of ***Professor Girault***, which describes the development of novel analytical techniques. Medical applications have great potential to be further developed in collaboration with analytical chemistry groups at the HES in Sion.

In addition to these groups we are very pleased to introduce two additional assistant professors in Chemical Engineering who will join us during the coming year in Sion. The current issue gives some of the ideas of the research that is planned in Sion. The Sion team is very grateful to the Canton of Valais and the city of Sion for creating the opportunity to start this exciting new line of research.

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