

Michael Graetzel (Switzerland)

“For transcendent merits in development of low cost and efficient solar cells, known as “Graetzel cells”, aimed to creation of cost-efficient, large-scale engineering solutions for power generation”.



He was born on May 11, 1944 in Dorfchemnitz commune (Germany)

Short biography

- In 1968 he graduated from Free University of Berlin, in 1971 he has earned the Doctor of Philosophy in natural science in Technical University of Berlin.
- In 1976 he has earned Doctor of Science in physical chemistry.
- Since 1977 to the present day he works in Federal Polytechnic School of Lausanne and directs the laboratory of Photonics and Interfaces.
- He acted as postdoc, lecturer, visiting professor in Berlin Institute for Nuclear Researches named after Hahn and Meitner, Free University of Berlin, University of California, Oil and Gas Research Fund University Notre Dame (USA), and other educational and research centers.
- In 1991 he has published his breakthrough work with Nature magazine with regard to the new type of solar cells – photo-sensitive mesoporous oxide semiconductors with wide band gap that have brought the name of Professor into repute and were named as Graetzel cells.
- Michael Graetzel is the holder of 10 honorary doctorates in Universities of Asia and Europe: Denmark, Holland, China, Sweden, Singapore, and other countries. He is the laureate of tens of prestigious scientific and engineering prizes, such as Grand Prix “Millennium Technology”, Medal of Faraday granted by British Royal Society, Gutenberg Prize, Albert Einstein Prize, and others.
- He is the member of Swiss Chemical Society, Society of Max Plank, and German Academy of Natural Scientists, as well as the honorable member of Israeli Chemical Society, Bulgarian Academy of Science and British Royal Chemical Society.

Scientific achievements

- Michael Graetzel is one of developers of the so-called Graetzel cell operating on the principles of photosynthesis – the process similar to biochemical one and used by plants for light energy conversion into carbohydrates. The invention developed by the scientist since 1970th of past century represents profitable alternative for expensive and sophisticated technologies of photovoltaic arrays produced on the basis of silicon (in particular, the latter require expensive silicon of high purity).

Compared to silicon-based batteries the Graetzel cells are rather simple and manufactured of low cost materials.

- First Graetzel cells, discovered in 1991, were based upon porous layer of nanoparticles of titanium oxide covered with organic dye. Electrons from organic dye, able to efficiently adsorb solar radiation, migrate into conductive electrode made of titan dioxide and generate the electric flux.
- Commercial manufacturing of such cells was started just in 2009. At the initial stage, they possessed poor efficiency performances of 3-8% and poor stability due to available unstable liquid electrolyte and organic dye inside the cells. Their efficiency was raised up to 11,9 % by 2012.
- During 20 years researchers headed by Graetzel and many other groups worked to change over from organic dye to perovskite materials and to replace liquid electrolyte with solid organic semiconductor. The new materials-based cell possessed high theoretic potential in terms of efficiency and swept the researchers with optional rapid boost in device performance factor. As a result, in 2012 Michael Graetzel became a pioneer in the development of perovskite solar cells based on Graetzel cells. Their efficiency nowadays - 22.1%.
- Michael Graetzel continues his works on development of perovskite photovoltaics all over the world, in particular he actively cooperates with scientific team from the Moscow State University. The scientist and his colleagues possess several records in terms of perovskite solar cells efficiency.
- Nowadays Graetzel remains one of absolute leaders in the area of perovskite photovoltaics. In particular, he works on creation of fuel cells based upon perovskite cell, and has succeeded in high efficiency of water photolysis (with hydrogen generated).
- He is the author of more than 1300 publications, two monographies, he holds more than 50 patents. He is one of ten most cited global chemists-scientists.

Interesting facts

- Graetzel cell-based batteries are more convenient for consumer compared to silicon-based photocells – they could be made flexible and in various colors. It is convenient for use and power generation, for instance, in various structural elements of buildings. It is possible to create structurally transparent cells able to generate electric power within various bands of light frequencies, up to infrared one. It means that, in particular, they could be embedded into window glasses resulting in double effect for premises cooling and associated electric power generation.
- Several companies have already started commercial manufacture of photocells based upon renewed Graetzel cells.