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Catalytic conversion of materials had been observed early on, and during the Industrial Revolution in the mid-18th century, some catalytic reactions were already employed on an industrial scale at that time. However, catalysis science as a branch of modern science was established for the first time when Ostwald carried out a detailed study on reaction rates and chemical equilibria at the end of 19th century. In his study, he noted, “catalysis is a chemical acceleration brought about by the presence of substances which do not appear in the reaction product”.¹⁾

The chemical industry today supports an ever-growing world population by providing essential materials used in everyday life (clothing, food, housing/building, etc.), and in many industries (energy, manufacturing, transportation, pharmaceutical, information, etc.), for which catalysts have been one of the main engines. Nevertheless, the very nature of catalysts as mentioned above (not appeared in its end-products) makes their contributions hardly visible to the general public. Save for the publicity given by the Nobel Prize in Chemistry every year. To date, there have been 28 Nobel Laureates (which accounts for 15% of all Laureates in Chemistry) directly related to catalysis science. For example, prizes were given for ammonia synthesis by the Haber-Bosch process (saving humanity from hunger), for Ziegler-Natta catalysts for polyolefins production (the most used plastics in the world today), for the myriad transition metal molecular catalysts for asymmetric reactions, cross-coupling reactions, and metathesis reactions (enabling complex and sophisticated organic syntheses for pharmaceuticals and ICT materials, etc.), the list goes on. In addition to creating new materials, catalysts have made industrial processes more efficient by reducing energy/resources consumption, and by eliminating by-products waste. Therefore, catalysts are also important and essential for green chemistry. Additionally, catalysts aid in the removal of and/or decomposition of pollutants from exhaust/wastewater at automobile and other factories, greatly improving air and water quality.

Mitsui Chemicals, which originated within the chemical division of Mitsui Coal Mine in 1912, started with inorganics and coal chemicals, moving to petrochemicals in the 1950's, and has now become a global provider of a variety of chemicals/polymers with high performance. Over the 100 years of its history, Mitsui Chemicals has successfully developed a number of high performance catalysts, for example, solid and molecular catalysts for olefin polymerization, and biological/enzymatic catalysts for bio-acrylamide. Reflecting on our history of technological development, we have regarded catalysis science as a key technology for sustainable development of society. Thus from 2003, we hosted an international symposium on catalysis science, and since 2004, we have established the Catalysis Science Award and the Catalysis Science Award of Encouragement to honor the researchers who have made outstanding achievements in the field.

Since the Industrial Revolution, and particularly since the 1950s, man has been burning fossil fuels to get energy and materials we need, causing an increase in atmospheric CO₂ concentration over 200+ years at an alarming rate. As the direct consequence of these increases, we now face human-induced global climate change and global warming as a global challenge. In order to get rid of dependence on fossil fuels, it is essential to promote the use of renewable energy, to develop technologies for improved energy-efficiency (weight reduction, heat insulation, etc.), and to convert non-fossil resources (biomass, CO₂, etc.) into chemicals and energy. Furthermore, the United Nations called for actions to reach the Sustainable Development Goals (SDGs) by 2030, each of which carries its own unique challenge.

In order to tackle these urgent challenges, catalysis science will have to play an ever-important role, as will the Catalysis Science Forum 2021 by promoting cooperation between industry, academia, and government, and by instituting international partnerships.

1) MLA style: Wilhelm Ostwald – Nobel Lecture. NobelPrize.org. Nobel Prize Outreach AB 2021. Fri. 16 Jul 2021. <https://www.nobelprize.org/prizes/chemistry/1909/ostwald/lecture/>

PROFILE

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