LONGDOM CONFERENCES

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The age of methanol and hydrogen economies.The conversion of green- house gases CO_2 and methane[1]. The influence of alcohol reaction kinetics in gas phase and liquid phase on size-controlled Pt nanoparticles

Need for clean energy is imminent and methanol is considered a promising alternative energy source. Conventional process for the production of methanol has been achieved via syngas, which is derived by the steam reforming of methane or naphtha and the gasification of coal. Methanol can also be prepared by direct oxidation of methane (natural gas) or reduction of carbon dioxide (CO_2) with hydrogen. In this way, carbon-neutral cycling can be achieved and the world's dependence on fossil fuels will be alleviated. In this presentation, we will address, case by case, some recent advancements in the conversion of methane and CO_2 to methanol both homogeneously and heterogeneously with emphasis on the contribution from Professor George A. Olah's and our group. In the end, a short outlook is provided towards existing problems and future opportunities. Alcohol oxidation reaction over platinum nanoparticles with size ranging from 2 to 8 nm deposited on mesoporous silica MCF-17 was studied in the gas and liquid phases. Among methanol, ethanol, 2-propanol, and 2-butanol oxidations, the turnover frequency increased as the nanoparticle size became large in both reaction phases. The activation energy in the gas phase was higher than that in the liquid phase. Water co-adsorption decreased the turnover rate of all the gas and liquid phase oxidations except for the gas-phase 2-butanol case, while certain amount of water promoted 2-propanol oxidation in the liquid phase. Sum Frequency Generation vibrational spectroscopy (SFG) study and DFT calculation revealed that the alcohol molecules pack horizontally on the metal surface in low concentration and stand up in high concentrations, which affect the dissociation of ß-hydrogen of the alcohol as the critical step in alcohol oxidation.

Biography: Gabor A. Somorjai has been a leader in the field of catalysis for more than 45 years. He has published almost 1200 papers and 4 books. He received his Ph.D. in Chemistry from the University of California, Berkeley in 1960 and he was appointed to the faculty there in 1964. Since then, he has won just about every honor in his field. In 2011 he was the recipient of the Honda Prize, the ENI New Frontiers of Hydrocarbons Prize and the BBVA Foundation Frontiers of Knowledge Award. He has received the Priestley Medal (2008), the National Medal of Science (2002) the Wolf Prize (1998). Somorjai became a member of the National Academy of Sciences in 1979 and the American Academy of Arts and Sciences in 1983.

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