Catalysis Today 359 (2021) 1–2

Contents lists available at ScienceDirect

Catalysis Today

journal homepage: www.elsevier.com/locate/cattod

Catalytic & adsorption reactions in chemical ProcessEs (CARPE)

Supplies of energy resources will eventually be limited due to its finite quantities. Striving to replenish energy resources has been carried out in a variety of research fields to seek solutions, especially from physical chemistry and electrochemistry. Importance on these fields has been highlighted to surface analysis and dynamics especially in catalytic and adsorption reactions in chemical processes. Scientific approaches to probe the surface reactions have been mostly initiated with the adsorption reactions at the surface of the catalyst.

Designs of catalytic materials with high activity and selectivity control over their intermediates or products have been developed with various fabrication methods and surface modifications of the catalysts. However, the principle of high activity and selectivity is based on the interfacial study. Attempts to understand the interfaces of different phases mainly focus on the charge transfer to overcome their potential differences. The charge transfer processes across the interfaces are not only chemically modified but electrochemically polarized to improve

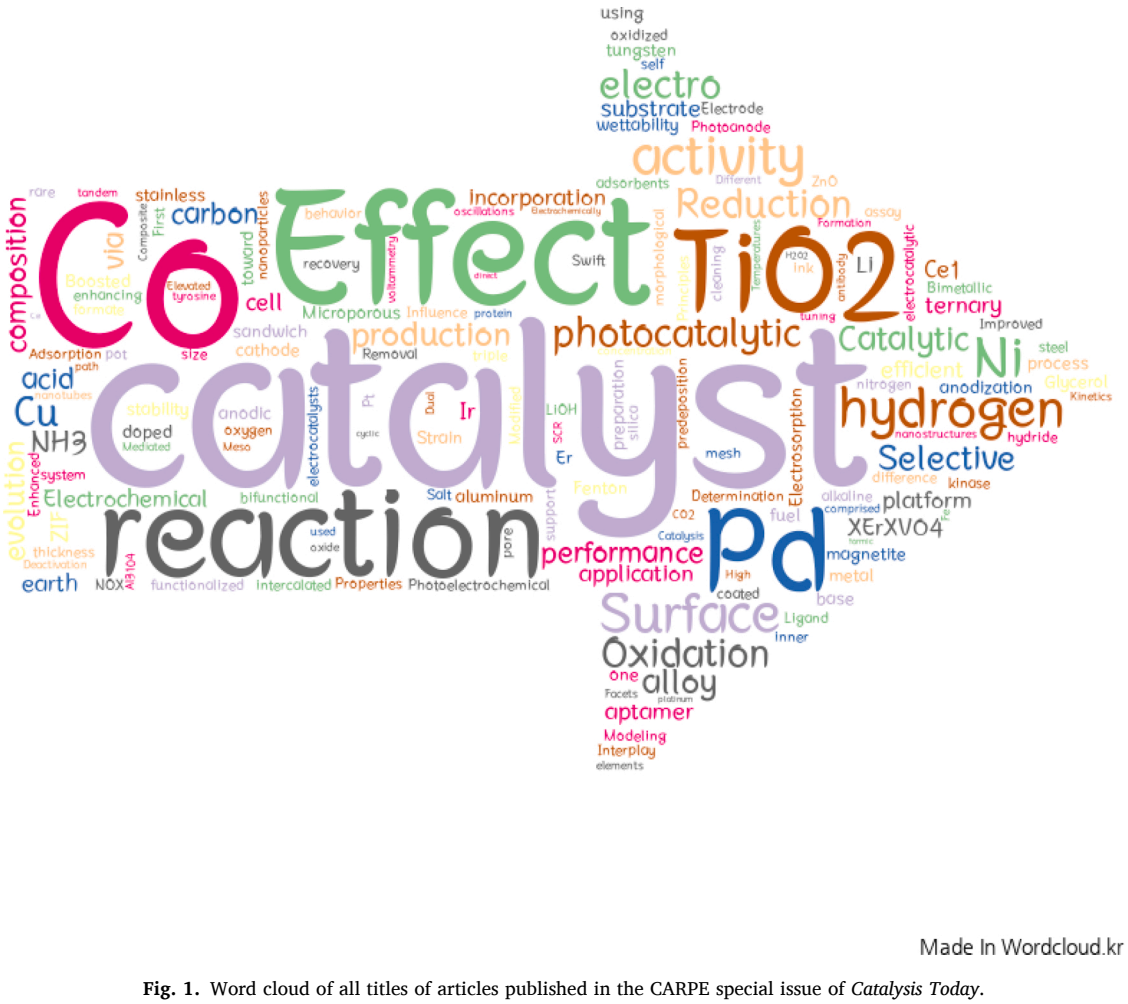

Fig. 1. Word cloud of all titles of articles published in the CARPE special issue of *Catalysis Today*.

https://doi.org/10.1016/j.cattod.2020.08.023

Available online 28 August 2020

Table 1
List of accepted publications for the special issue of CARPE.

Type of publication	First author/Corresponding author/Title
Research article	•Mun Kyoung Kim, Youngkook Kwon, Electrochemically Li-intercalated TiO_2 nanoparticles for high performance photocatalytic production of hydrogen •Dong Wook Kwon, Influence of support composition on enhancing the performance of Ce-V on TiO2 comprised tungsten-silica for NH_3-SCR •Yubin Lee, Sanghan Lee, Surface-modified Co-doped ZnO photoanode for photoelectrochemical oxidation of glycerol •Seoni Kim, Jeyong Yoon, Electrochemical recovery of LiOH from used CO_2 adsorbents •Kahyun Ham, Jaeyoung Lee, Improved electrosorption kinetics in meso/microporous carbon composite electrode for swift salt removal •Sujik Hong, Jaeyoung Lee, The effect of morphological difference and hydride incorporation on the activity of Pd/C catalysts in direct alkaline formate fuel cell •Deok Yeon Jo, Kwan-Young Lee, Interplay of ligand and strain effects in CO adsorption on bimetallic Cu/M (M = Ni, Ir, Pd, and Pt) catalysts from first-principles: Effect of different facets on catalysis •Jongsik Kim, Er composition (X)-mediated catalytic properties of $Ce_{1-x}Er_xVO_4$ surfaces for selective catalytic NO_x reduction with NH_3 at elevated temperatures •Jaewon Lee, Kiyoung Lee, Formation of aluminum oxide nanostructures via anodization of Al3104 alloy and their wettability behavior for self-cleaning application •Seunghyun Jo, KwangSup Eom, Enhanced activity and stability of Co-Ni-P-B catalyst for the hydrogen evolution reaction *via* predeposition of Co-Ni on a Cu substrate •Yu-Ri Lee, Kyung-Youl Baek, Dual-functionalized ZIF-8 as an efficient acid-base bifunctional catalyst for the one-pot tandem reaction •Yun Jeong Choe, Sang Hoon Kim, An electro-fenton system with magnetic coated stainless steel mesh as cathode •Minhee Suk, Chang Hyuck Choi, Selective H_2O_2 production on surface-oxidized metal-nitrogen-carbon electrocatalysts •Sanghyuk Lee, Hye Jin Lee, Determination of protein tyrosine kinase-7 concentration using electrocatalytic reaction and an aptamer-antibody sandwich assay platform •Alfredo Calderón-Cárdenas, Hamilton Varela, Modeling the triple-path electro-oxidation of formic acid on platinum: Cyclic voltammetry and oscillations •Gajeon Chon, Chang Hyuck Choi, Deactivation of Fe-N-C catalysts during catalyst ink preparation process •Hyeonkwon Lee, Kiyoung Lee, Boosted photocatalytic hydrogen evolution by tunning inner pore size and co-catalyst thickness of the anodic TiO_2 nanotubes •Chanho Park, Effect of rare-earth elements in Pd ternary alloy catalysts on activity toward oxygen reduction reaction

catalytic reactions, which might control the binding strength of reaction intermediates and their molecular orientations at interfaces. Further researches on interface chemistry have been established with kinetic model using computational calculations. The adsorption energies of molecules on surfaces, transition states, and reaction rates have been calculated to postulate reaction pathways (Fig. 1, Table 1).

Improvements on the resolution of spectroscopic tools have also enabled to probe information on the nature of reactant intermediates as well as its related surface chemistry. Various *in situ* analytical techniques such as infrared spectroscopy (IR) and ambient pressure XPS (APXPS) allow detection of chemical species including intermediates at the sub-layer surface coverages and structural information on chemical environment at interfaces. Even more, dynamic observation of interfacial species on molecular level and ultrafast time scale has become possible (*e.g.* video-STM). Recently, their significant benefits are derived in the field of electrochemistry. Their detection of catalytic and adsorption processes at metal substrate defines specific features of adsorbed species as intermediates examined in electrochemical oxidation/reduction pathways of organic/inorganic species. However, when the potential of working electrode are modulated, their potential difference spectra at electrode-solution interfaces can display highly specific features for chemical species and induce its chemical transformation. Thus, the appropriate strategy to control reactivity of active chemical species and extended approaches to examine other structural factors impacting on its reactivity such as geometrical adsorption sites should be further investigated.

Finally, the catalytic reaction involved with the adsorption process should be investigated down to minute details to understand each elementary steps and more sophisticated systematic approaches should be continuously developed to enable better understanding of the real catalytic reaction.

At the 5th Ertl symposium (25-28th November 2018), which was organized by the Ertl Center at GIST under special encouragement in Electrochemistry and Catalysis (Gwangju, South Korea), diverse research topics were introduced and discussed around participated researchers in efforts to seek scientific solutions for serious problems in the 21st century, such as environment, climate, energy conversion, and water. The present Catalysis Today mainly deals with catalytic and adsorption reactions in chemical processes, in connection with surface analysis and dynamics in physical chemistry and electrochemistry. Here is a great opportunity to share all the aged or newly developed research fields of whole spectrum from fundamental approach to application and devices. These attempts are expected to be contributable to our future work and progress in electrochemistry and catalysis.

Jaeyoung Lee[a,b,*], Changhyuk Choi[c], Sanghoon Kim[b,d]
[a] *Ertl Center for Electrochemistry and Catalysis, Gwangju Institute of Science and Technology, Gwangju 61005, South Korea*
[b] *School of Earth Sciences and Environmental Engineering, Gwangju Institute of Science and Technology, Gwangju 61005, South Korea*
[c] *School of Materials Sciences and Engineering, Gwangju Institute of Science and Technology, Gwangju 61005, South Korea*
[d] *Center for Materials Architecturing, Korea Institute of Science and Technology, Seoul 02792, South Korea*

[*] Corresponding author at: Ertl Center for Electrochemistry and Catalysis, Gwangju Institute of Science and Technology, Gwangju 61005, South Korea.
E-mail address: jaeyoung@gist.ac.kr (J. Lee).