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KIT Energy News

에너지융합기술 혁신인재 양성사업단

Innovative Education & Research Center for Energy Convergence Science and Technology

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‘4단계 BK21 사업’ 예비 선정

- ‘혁신인재 양성사업’ 유형의 2개 분야 선정
- “스마트 제조 혁신과 신재생 에너지 산업 활성화 기대”

우리 대학 2개 사업단이 ‘4단계 두뇌한국(BK)21 사업’에 예비 선정됐다.

6일 교육부 발표에 따르면, 우리 대학은 ‘혁신인재 양성사업(지역)’유형에서 ‘스마트공장’ 및 ‘에너지신산업’분야 교육연구단이 선정됐다. 혁신인재 양성사업은 융·복합형 연구 인력 양성 수요에 따라 이번 4단계 BK21 사업에서 신규 신설된 분야다.

스마트공장 분야의 ‘스마트 제조 혁신을 위한 MERIT (Medical, Electronic, Robotic, IT) 융합 혁신 인재 양성단(단장 신수용 전자공학부 교수)’은 지역 산업단지의 특성과 기업 요구에 기초한 전자, 로봇, 의공학, IT 분야를 아우르는 융합형 인재 양성을 통해 지역의 스마트 제조 혁신을 이룬다는 계획이다.

에너지신산업/신재생에너지 분야의 ‘에너지융합기술 혁신인재 양성사업단(단장 박철민 신소재공학부 교수)’은 미래 신재생에너지 산업을 위한 융합적 지식이 풍부한 혁신적인 전문 공학인 양성을 목표로, 학제/전공 간 융합 교육 및 연구를 통해 지역 신재생 에너지 관련 산업 활성화에 기여할 것으로 기대하고 있다.

에너지융합기술 혁신인재 양성사업단을 이끌게 된 박철민 교수는 “신재생에너지와 관련한 실용적이고 기술 중심적인 교육과 연구, 그리고 지역 신재생 산업체와의 유기적 협력을 바탕으로 실무 역량을 갖춘 석박사급 고급 연구인력 양성에 주력할 것”이라며, “신재생에너지 시스템의 선도적 융복합을 통해 세계적 수준의 연구 중심 대학원으로 도약하도록 노력하겠다”고 말했다.

한편, 4단계 BK21 사업은 3단계 BK21 플러스 사업 후속으로 오는 9월부터 7년간 진행된다. 2개 분야(미래인재 양성사업·혁신인재 양성사업)로 나뉘어 대학원생 연구장학금, 신진연구인력 인건비 등 지원을 통해 4차 산업혁명을 선도할 석·박사급 연구 인력을 양성하는 사업이다. 최종 선정은 이의제기 기간을 거쳐 9월 중 확정된다.

금오공과대학교 KIT Projects(2020.08.07) https://www.kumoh.ac.kr/ko/sub01_05_01.do?mode=view&articleNo=240266

◈ 관련 기사 ◈

경북매일신문	금오공대, 스마트공장·에너지신산업 혁신 나서	https://www.kbmaeil.com/news/articleView.html?idxno=853418
신아일보	금오공대, 교육부 ‘4단계 두뇌한국(BK)21 사업’ 예비 선정	http://www.shinailbo.co.kr/news/articleView.html?idxno=1307682
경북일보	금오공대, 4단계 두뇌한국21 예비선정…"혁신인재 양성"	https://www.kyongbuk.co.kr/news/articleView.html?idxno=2049269
국제뉴스	금오공대, ‘단계 BK21 사업 예비 선정	http://www.gukjenews.com/news/articleView.html?idxno=2052222
경북매일신문	금오공대, 4단계 두뇌한국21 사업 예비 선정	http://www.ksmnews.co.kr/default/index_view_page.php?idx=302540&part_idx=300
대구일보	금오공대 4단계 두뇌한국(BK)21 사업 예비 선정	http://www.idaegu.com/newsView/idg202008090022
경북도민일보	금오공대 ‘4단계 BK21 사업’ 예비 선정	http://www.hidomin.com/news/articleView.html?idxno=429184
뉴시스	금오공대 ‘4단계 BK21 사업’ 예비 선정	https://newsis.com/view/?id=NISX20200807_0001122414&cID=10810&pID=10800#
브레이크뉴스	금오공대 ‘4단계 BK21 사업’ 예비 선정	http://www.breaknews.com/747388#
뉴데일리	금오공대, ‘4단계 BK21 사업’ 2개 분야 예비 선정	http://tk.newdaily.co.kr/site/data/html/2020/08/07/2020080700100.html
e-대학저널	금오공대 ‘4단계 BK21 사업’ 예비 선정	http://www.dhnews.co.kr/news/articleView.html?idxno=126770
머니투데이	금오공대 2개 사업단, ‘4단계 BK21 사업’ 예비 선정	https://news.mt.co.kr/mtview.php?no=2020080710467489192
한국대학신문	금오공대, ‘4단계 BK21 사업’ 예비 선정	http://news.unn.net/news/articleView.html?idxno=233222
베리타스알파	금오공대, 4단계 BK21 사업 예비 선정	http://www.veritas-a.com/news/articleView.html?idxno=335134

KIT Energy 소식

우리 대학 '4단계 BK21 사업' 3개 사업단 출범

- '혁신인재 양성사업' 유형의 3개 분야 사업 최종 선정
- 4차 산업혁명 선도하는 연구중심 대학 기대

우리 대학 3개 사업단이 4단계 두뇌한국(BK)21 사업에 최종 선정됐다.

지난 8월 'BK21스마트제조MERIT융합사업단'과 'BK21에너지융합사업단'이 예비 선정된 데 이어, 지난달 'BK21국방항공융합사업단'이 현장점검을 거쳐 추가 선정되며 최종 3개 사업단이 4단계 BK21 사업에 선정됐다.

스마트공장 분야의 'BK21스마트제조MERIT(Medical, Electronic, Robotic, IT)융합사업단(단장 신수용 전자공학부 교수)'은 지역 산업단지의 특성과 기업 요구에 기초한 전자, 로봇, 의공학, IT 분야를 아우르는 융합형 인재 양성을 통해 지역의 스마트 제조 혁신을 이룬다는 계획이다.

에너지신산업/신재생에너지 분야의 'BK21에너지융합사업단(단장 박철민 신소재공학부 교수)'은 학제/전공 간 융합 교육 및 연구를 통해 지역 신재생 에너지 관련 산업 활성화에 기여할 것으로 기대하고 있다.

소재ㆍ부품ㆍ장비 분야의 'BK21국방항공융합사업단(단장 박준영 기계설계공학과 교수)'은 항공, 기계 전자 등 다양한 학문 분야의 융복합 전문지식 교육을 통해 국방·항공 산업에 필요한 소재·부품·장비 기술을 선도하는 지역 R&D 인력을 양성할 예정이다.

우리 대학은 산학협력단 운영기관으로 3개 사업단의 학내 조직 설치를 완비하여 본격적으로 4단계 BK21 사업을 추진하게 됐다. 각 사업단은 사업단별 비전과 목표에 맞춰 교육·연구·산학협력 등의 다양한 영역에서 4차 산업혁명을 선도할 석·박사급 연구 인력을 양성할 계획이다. 사업비는 사업유형, 지원단위, 세부분야를 고려하여 11월 중 한국연구재단과 협약을 체결하며 최종 확정된다.

금오공과대학교 KIT Projects(2020.11.10) https://www.kumoh.ac.kr/ko/sub01_05_01.do?mode=view&articleNo=244721

◈ 관련 기사 ◈

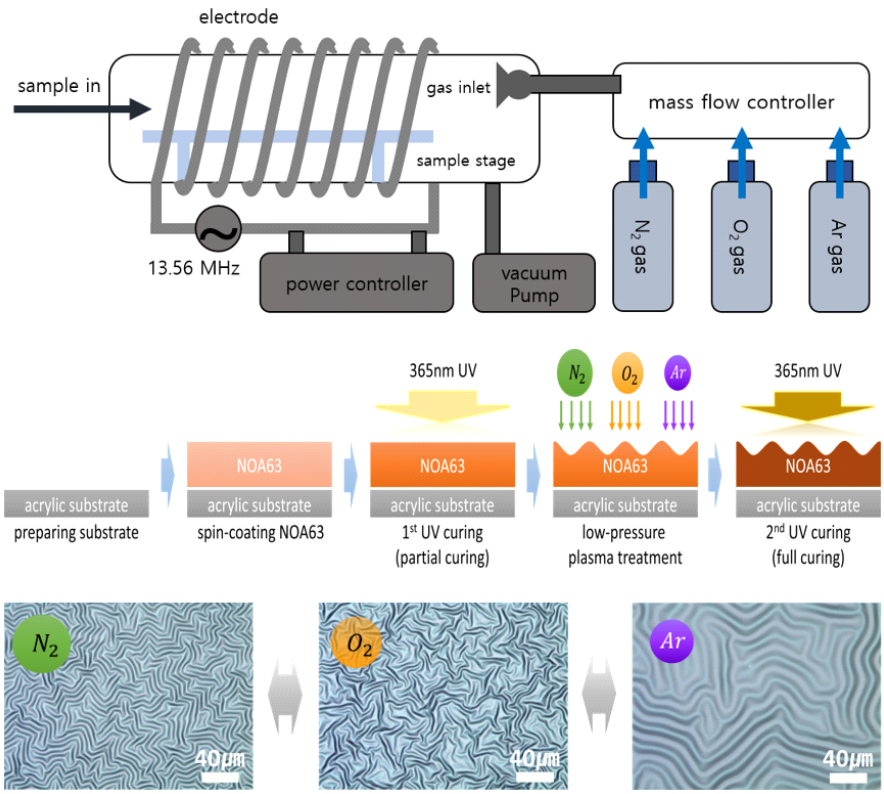
신아일보	금오공대 '4단계 BK21 사업, 3개 사업단' 출범	http://www.shinailbo.co.kr/news/articleView.html?idxno=1342474
대구일보	금오공대, 4단계 두뇌한국(BK)21 사업에 3개 사업단 선정	http://www.idaegu.com/newsView/idg202011110077
경상매일신문	금오공대 '4단계 BK21 사업' 3개 사업단 출범	http://www.ksmnews.co.kr/default/index_view_page.php?idx=313421&part_idx=300
대구신문	구미 금오공대, 3개 사업단 '4단계 BK21' 선정	https://www.idaegu.co.kr/news/articleView.html?idxno=328408
경북매일신문	금오공대, '4단계 BK21 사업' 3개 사업단 출범	https://www.kbmaeil.com/news/articleView.html?idxno=860729
경북도민일보	금오공대 '4단계 BK21 사업' 3개 사업단 출범	http://www.hidomin.com/news/articleView.html?idxno=437102
e-대학저널	금오공대, '4단계 BK21 사업' 3개 사업단 출범	http://www.dhnews.co.kr/news/articleView.html?idxno=131303
뉴시스	금오공대 '4단계 BK21 사업' 3개 사업단 출범	https://newsis.com/view/?id=NISX20201110_0001229114&cID=10810&pID=10800#
브레이크뉴스	금오공대, '4단계 BK21 사업' 3개 사업단 출범	http://www.breaknews.com/766272
머니투데이	금오공대, '4단계 BK21 사업' 3개 사업단 선정	https://news.mt.co.kr/mtview.php?no=2020111015407453860
한국대학신문	금오공대 '4단계 BK21 사업' 3개 사업단 출범	http://news.unn.net/news/articleView.html?idxno=236879
국제뉴스	금오공대, '4단계 BK21 사업' 3개 사업단 선정	http://www.gukjenews.com/news/articleView.html?idxno=2106049

태양에너지

Materials
Volume 13, September 2020, p3852 (Impact Factor: 3.057)

Effect of low-pressure plasma treatment parameters on wrinkle features

Bongjun Gu, Dongwook Ko, Sunjin Jo, Dong Choon Hyun, Hyeon-Ju Oh, Prof. Jongbok Kim*



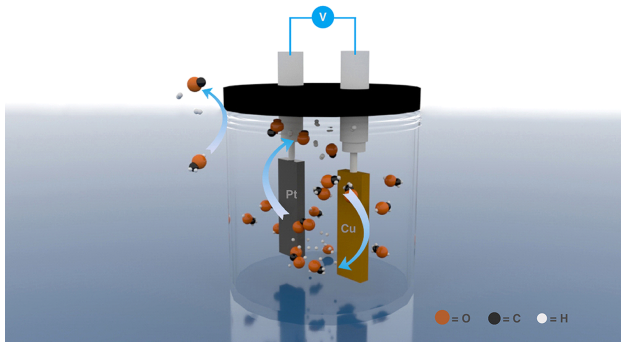
Wrinkles attract significant attention due to their ability to enhance the mechanical and optical characteristics of various optoelectronic devices. We report the effect of the plasma gas type, power, flow rate, and treatment time on the wrinkle features. When an optical adhesive was treated using a low-pressure plasma of oxygen, argon, and nitrogen, the oxygen and argon plasma generated wrinkles with the lowest and highest wavelengths, respectively. The increase in the power of the nitrogen and oxygen plasma increased the wavelengths and heights of the wrinkles; however, the increase in the power of the argon plasma increased the wavelengths and decreased the heights of the wrinkles. Argon molecules are heavier and smaller than nitrogen and oxygen molecules that have similar weights and sizes; moreover, the argon plasma comprises positive ions while the oxygen and nitrogen plasma comprise negative ions. This resulted in differences in the wrinkle features. It was concluded that a combination of different plasma gases could achieve exclusive control over either the wavelength or the height and allow a thorough analysis of the correlation between the wrinkle features and the characteristics of the electronic devices.

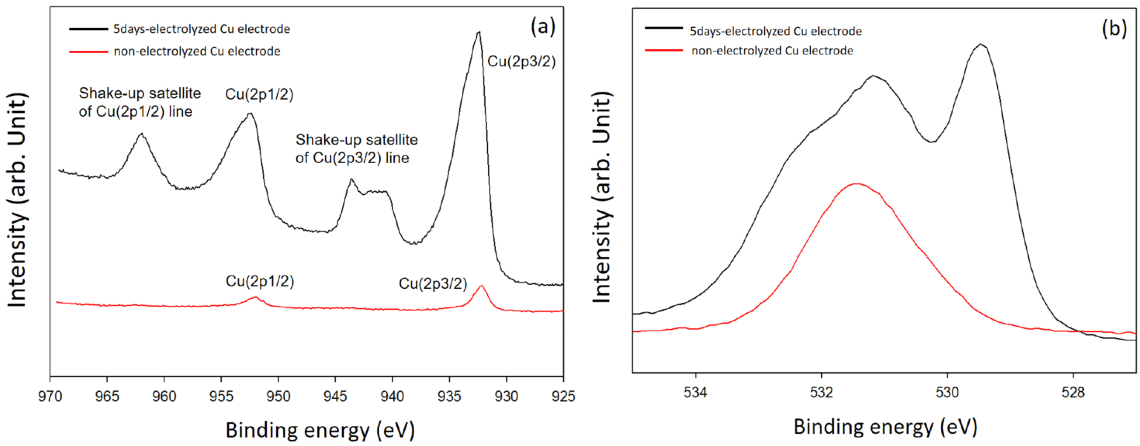
수소에너지

International Journal of Hydrogen Energy
Volume 45, September 2020, p31418 (Impact Factor: 4.939)

Dehydrogenation of pure methanol in an alkaline solution using copper electrodes

Sang-Won Woo, Chan-Soo Kim, Sung-Eun Lee, Tae-Oh Kim*





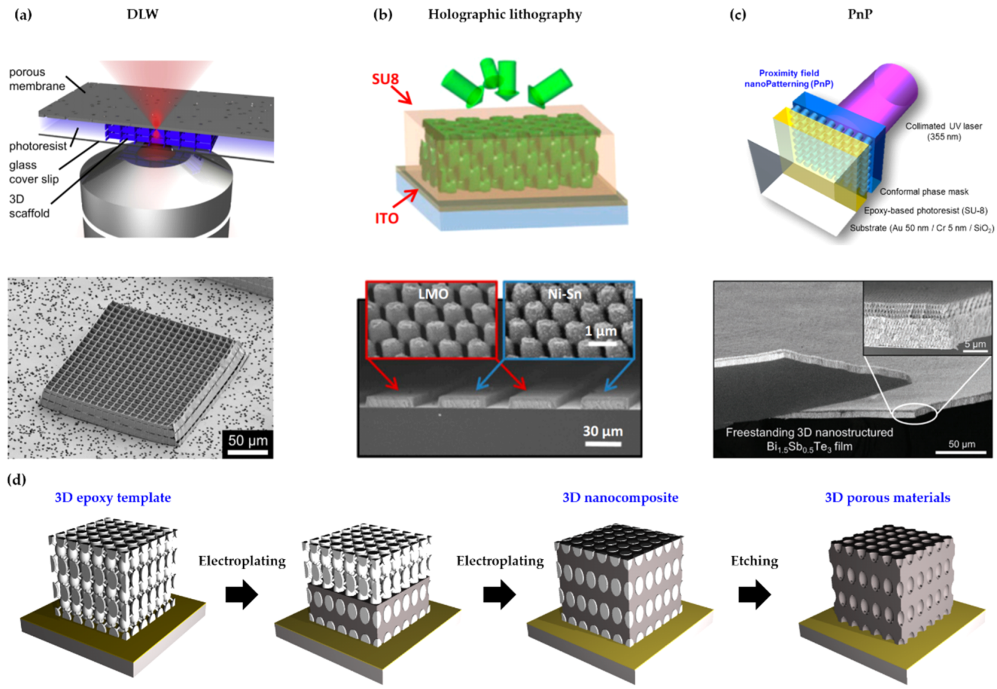
Herein, we focused on electrolysis to produce hydrogen-based energy to reduce pollution and cost of energy generation by replacing platinum (Pt) and ruthenium (Ru) anodes with copper (Cu) anodes, while demonstrating that H_2 and CO can be obtained by dehydrogenating pure methanol in a non-compartment cell. Also this is a new study that is completely different from DMFC. Redox products of methanol and electrochemical efficiency were determined using various techniques. 1 V (vs Ag/AgCl [KCl sat']) was applied to quantitatively evaluate H_2 generation; on average, 801.17 mmol g1 L1 h1 of H_2 was generated. The Cu electrode was electrochemically stable under the stirring at 150 rpm, indicating reduced toxicity by CO adsorption. Gas-phase CO and H_2, along with liquid-phase formate, carbonate, and paraformaldehyde, were obtained; the main product was H_2. However, details of the dehydrogenation mechanism remain unclear, and merit further investigations.

에너지변환

Applied Sciences
Volume 10, December 2020, p8780 (Impact Factor: 2.474)

Electroplated Functional Materials with 3D Nanostructures Defined by Advanced Optical Lithography and Their Emerging Applications

Jinseong Ahn, Seokkyoon Hong, Young-Seok Shim and Junyong Park*



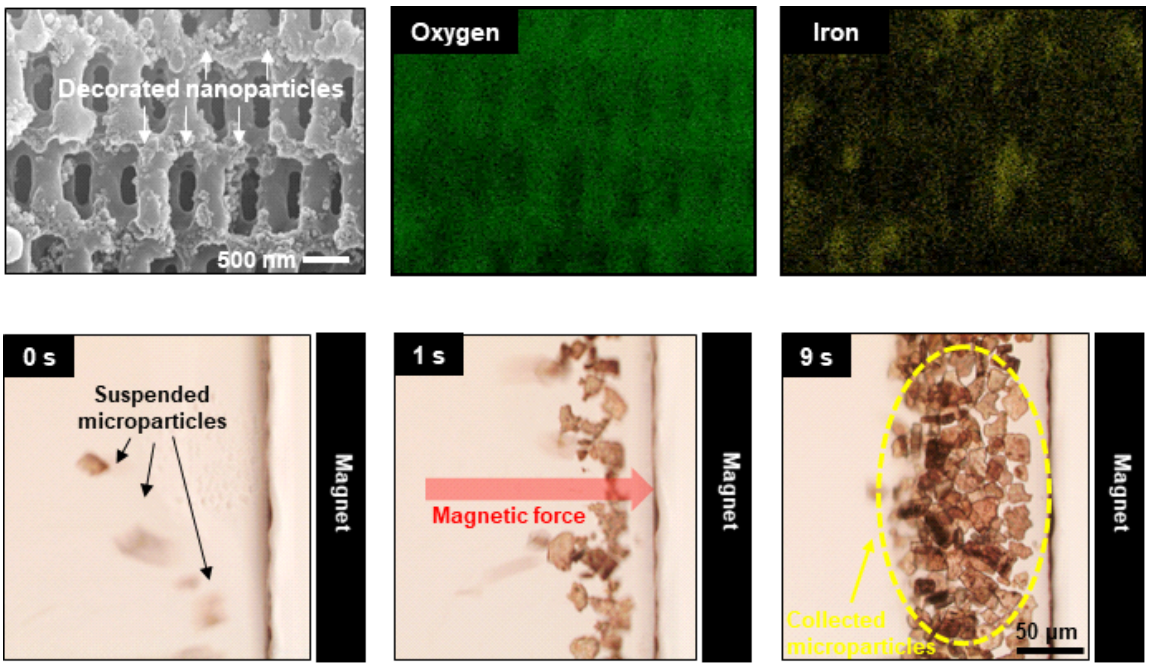
Electroplating has been favored to date as a surface treatment technology in various industries in the development of semiconductors, automobiles, ships, and steel due to its advantages of being a simple, solution-based process, with low cost and high throughput. Recently, classical electroplating has been reborn as an advanced manufacturing process for functional materials by combining it with unconventional optical three-dimensional (3D) nanofabrication techniques capable of generating polymer templates with high-resolution 3D periodic nanostructures. The bottom-up filling behavior of electroplating rising from a seed layer makes it possible to densely fill the nanoporous network of the template with heterogeneous inorganic materials. At this time, understanding and optimizing the process parameters (e.g., additive, current density, type of current waveform, etc.) of electroplating is critical for defect control. In addition, since electroplating is generally performed near room temperature, unlike other thin film deposition techniques, structural damage to the polymer template by heat during electroplating is almost negligible. Based on the excellent compatibility of electroplating and optical 3D nanofabrication, innovative functional materials with 3D periodic nanostructures targeting electrochemical or energy-related applications have been created. In this mini review, a strategy for producing functional materials with 3D periodic nanostructures through a templating process will be covered, and the recent cases of successful applications to electrodes for energy storage devices, electrocatalysts, and thermoelectric materials will be summarized. We will also discuss technical issues that need to be considered in the process to improve the quality of the resulting functional materials with 3D nanoarchitectures.

에너지변환

Functional Composites and Structures
Volume 2, December 2020, p045007 (Impact Factor: N/A)

3D-ordered porous composite microparticles formed via substrate-free optical 3D lithography

Jinseong Ahn, Junyong Ahn and Junyong Park*



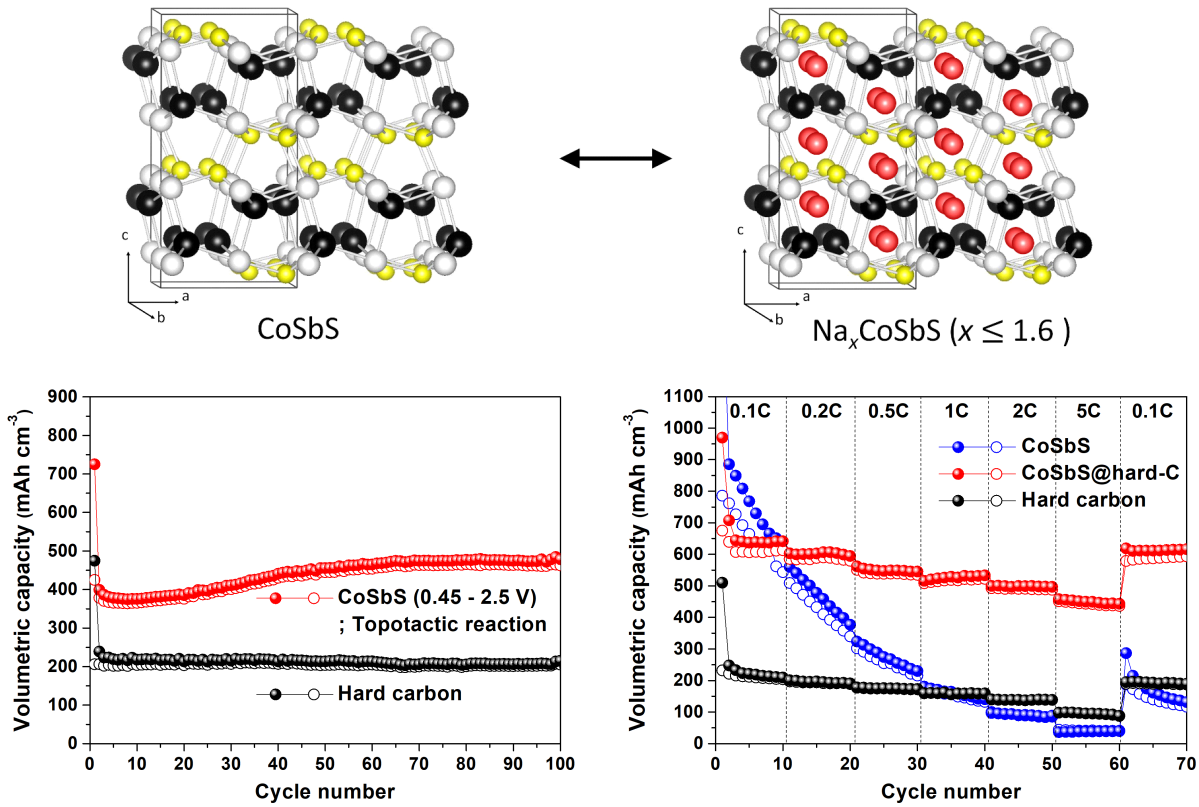
This paper proposes a cutting-edge photolithography-based top-down approach to produce functional porous microparticles with three-dimensional (3D) periodic nanostructures. The developed fabrication process employs proximity-field nanopatterning (PnP), a representative optical 3D nanofabrication technique in which a new type of phase mask and exposure scheme have been introduced. In the modified PnP mode, where the photoresist is directly coated on the phase mask, a 3D nanostructured membrane detaches from the mask during the development process. The freestanding 3D nanostructured membrane is electromagnetically shredded through simple ultrasonication to produce a large amount of 3D-ordered porous microparticles. A Gaussian distribution of particle sizes with an average size of ~37 μm can be obtained through an optimization of the sonication time. In addition, composite porous microparticles that exhibit exceptional magnetically responsive properties can be generated by incorporating iron oxide nanoparticles into the rinsing solution as nanofillers.

에너지저장

Materials Today Energy
Volume 17, September 2020, p100470 (Impact Factor: 5.604)

High-performance CoSbS-based Na-ion battery anodes

Yeon-Ho Jang and Prof. Cheol-Min Park*



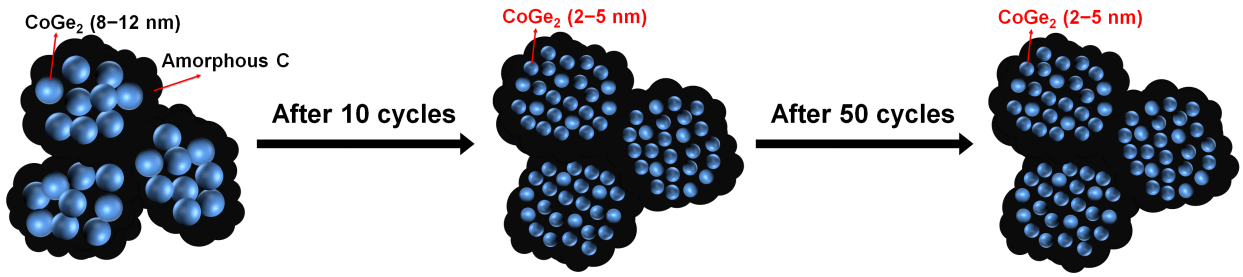
CoSbS and its hard carbon-containing nanocomposite (CoSbS@hard-C) are prepared via simple solidstate reactions, and their potential as Na-ion battery (NIB) anode materials is investigated. The electrochemical phase change mechanism of CoSbS during Na insertion/extraction is thoroughly investigated using various ex situ analytical tools. During Na insertion, the CoSbS undergoes a topotactic transformation owing to the formation of a NaxCoSbS (x=1.6), and then, it is converted into Na3Sb, Na2S, and Co in the fully Na-inserted state via a conversion reaction. Conversely, during Na extraction, Na3Sb transforms to Sb, which alloys with Co to form CoSb. In the fully Na-extracted state, CoSb and S from Na2S are recombined into CoSbS. Owing to the interesting reaction mechanism of CoSbS, the electrochemical performance of the CoSbS and CoSbS@hard-C anodes is excellent. Specifically, when CoSbS is used as a NIB anode, the topotactic transformation between CoSbS and NaxCoSbS (x 1.6) leads to stable cycling behavior of the NIB and a volumetric capacity of ~480 mAh cm3 is retained after 100 cycles. Additionally, the NIB with the CoSbS@hard-C anode presents highly reversible and stable capacity (~570 mAh cm3 after 150 cycles) and fast rate capability (~500 and ~450 mAh cm3 at 2C and 5C, respectively), which can be attributed to the presence of uniformly dispersed small (5~8 nm) CoSbS nanocrystallites in the hard carbon matrix. Therefore, CoSbS can be utilized as a new anode material for high-performance NIBs.

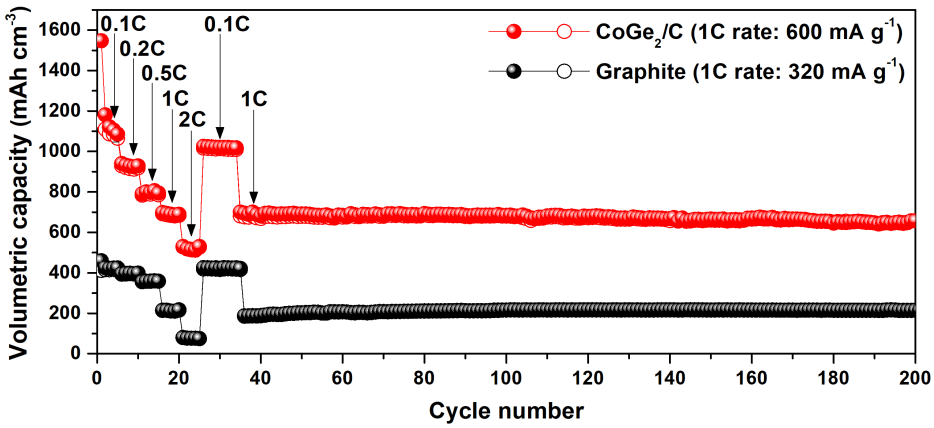
에너지저장

Materials Today Energy
Volume 18, December 2020, p100530 (Impact Factor: 5.604)

Co-Ge compounds and their electrochemical performance as high-performance Li-ion battery anodes

Do-Hyeon Kim and Prof. Cheol-Min Park*





Representative Ge-rich binary Co-Ge compounds (CoGe, Co_5Ge_7, and $CoGe_2$) are synthesized by facile solid-state reactions and apply as Li-ion battery (LIB) anode materials. Among the binary Co-Ge compounds studied, $CoGe_2$ shows the highest Li reversibility. Thus, a $CoGe_2$-decorated carbon composite ($CoGe_2$@C) is prepared to improve the electrochemical performance of CoGe2. Ex situ analysis results of X-ray diffraction and extended X-ray absorption fine structure demonstrate that the $CoGe_2$@C as an interesting mechanism of conversion/recombination during Li insertion/extraction. Owing to this continual conversion/recombination mechanism during cycling, the $CoGe_2$@C shows superior electrochemical performance. Specifically, $CoGe_2$@C shows high reversible capacity (1,106 and 973 mAh/cm3 at current density of 50 and 100 mA/g, respectively), stable cycling behavior (93.3% and 98.8% capacity retention at a cycling rate of 50 mA/g and 100 mA/g, respectively, after 100 cycling), and fast rate capability with stable cycling behavior (~700 mAh/cm3 at 1C rate over 200 cycles). Therefore, $CoGe_2$@C can be used as a high-performance LIB anode material.

환경에너지

Ultrasonics Sonochemistry
Volume 70, January 2021, p105334 (Impact Factor: 6.513)

Effects of gas sparging and mechanical mixing on sonochemical oxidation activity

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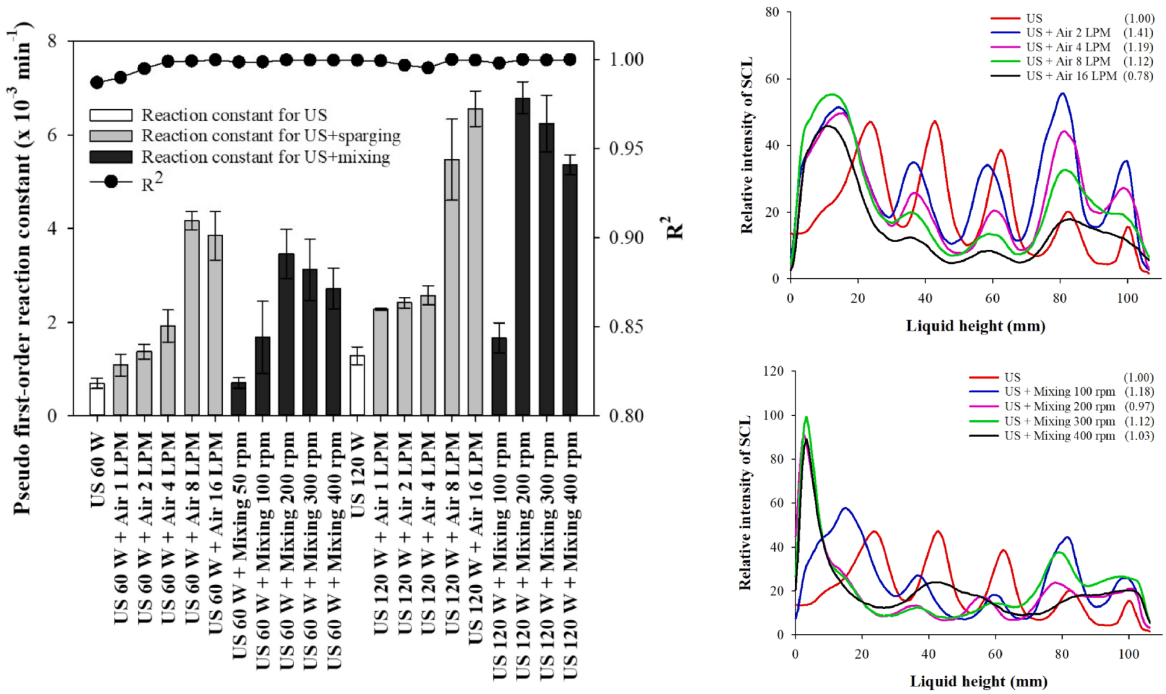

The effects of air sparging (0-16 L min^{-1}) and mechanical mixing (0-400 rpm) on enhancing the sonochemical degradation of rhodamine B (RhB) was investigated using a 28 kHz sonoreactor. The degradation of RhB followed pseudo first-order kinetics, where sparging or mixing induced a large sonochemical enhancement. The kinetic constant varied in three stages (gradually increased → increased exponentially → decreased slightly) as the rate of sparging or mixing increased, where the stages were similar for both processes. The highest sonochemical activity was obtained with sparging at 8 L min^{-1} or mixing at 200 rpm, where the standing wave field was significantly deformed by sparging and mixing, respectively. The cavitational oxidation activity was concentrated at the bottom of the sonicator when higher sparging or mixing rates were employed. Therefore, the large enhancement in the sonochemical oxidation was attributed mainly to the direct disturbance of the ultrasound transmission and the resulting change in the cavitation-active zone in this study. The effect of the position of air sparging and mixing was investigated. The indirect inhibition of the ultrasound transmission resulted in less enhancement of the sonochemical activity. Moreover, the effect of various sparging gases including air, N_2, O_2, Ar, CO_2, and an Ar/O_2 (8:2) mixture was compared, where all gases except CO_2 induced an enhancement in the sonochemical activity, irrespective of the concentration of dissolved oxygen. The highest activity was obtained with the Ar/O_2 (8:2) mixture. Therefore, it was revealed that the sonochemical oxidation activity could be further enhanced by applying gas sparging using the optimal gas.

환경에너지

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Glycolysis reactivity of D-isosorbide-containing copolyesters for chemical recycling of glycol-modified polyesters

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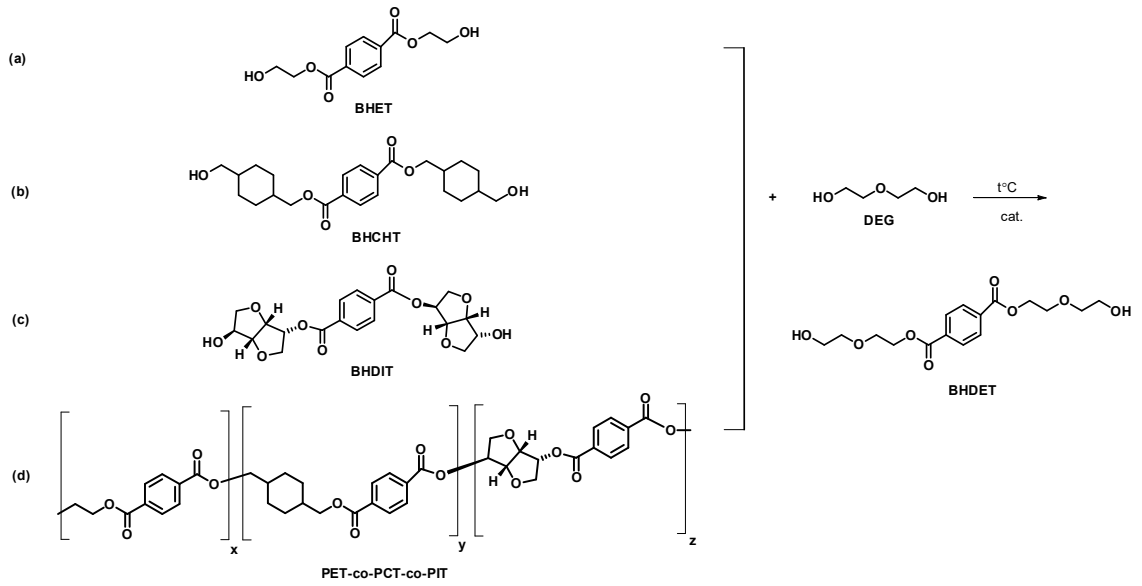

D-Isosorbide (ISB) is an attractive diol candidate for copolyester production because of its biological origin and desirable properties imparted by the resulting polyesters. However, the rigid structure and relatively unreactive hydroxyl groups in ISB can decrease the reactivity (toward glycolysis reactions) of ISB-containing polymers. To confirm the influence of the sterically hindered ISB moiety on the glycolysis of copolyesters, bis(6-hydroxyhexahydrofuro[3,2-b]furan-3-yl) terephthalate (BHDIT), a model compound for poly(isosorbide terephthalate) (PIT), was synthesized. The transesterification reactivity of BHDIT was compared with that of model compounds poly(ethylene terephthalate) (PET) and poly(cyclohexylendimethylene terephthalate) (PCT). BHDIT exhibited significantly reduced reactivity, with a reaction rate 5 times lower than that of PET. In the glycolysis of copolyesters consisting of PIT, PET, and PCT units, the PIT units exhibited a degradation of only 5% of the PIT units, indicating considerably higher stability than other polymer units. PET glycolysis with ISB, the reverse of PIT glycolysis, exhibited a reduced reaction rate, which was 0.17% of the reaction rate with diethylene glycol. In the glycolysis involving the ISB moiety, the sterically hindered bicyclic ring and secondary alcohol structure of ISB resulted in a decreased transesterification rate that was more than two orders lower than that of PET.