

이공계열 논문 작성법

How to Write a Scientific Paper

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- 1.** 이공계 논문의 특징 및 종류
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- 4.** 논문의 구성과 작성법
- 5.** 논문 온라인 업로드 및 심사프로세서
- 6. *R&D*** 연구방법과 논문작성 노하우

What is a Paper?

논문 (paper) 은 통상 우리가 **관심**을 가지고 있는 분야에 대해 **새롭게** 조사하고 연구한 바를 **정리**, 분석하여 **자신**의 입장을 밝힌 글을 말함

☞ 논문 작성의 중요 요건 (key points of writing a paper)

- 신규성 (new results or conceptual novelty)
- 독창성 (originality)
- 중요성 (significance)
- 객관성 (objectivity)
- 불편성 (Unbiasedness)
- 검증성 (verification)
- 평이성 (simplicity)

1. 이공계 논문의 특징 및 종류

- 논문의 길이가 짧다. (**Short manuscript**)
- 새로운 실험 결과에 근거를 둔다. (**Based on experimental results**)
(cf. computational paper 도 실험결과와 밀접한 연관성이 요구됨)
- 수식, 그림 등을 사용하여 간결하게 기술한다.

(**Concisely writing**)

- 장황한 설명이 거의 없다. (**No long explain**)
- 독창성이 있는 결론이 분명하게 드러난다. (**Original conclusion**)
- 인용법, 참고문헌 목록 작성 양식이 간단하고 합리적이다..

(**Rational quotation, reference and contents**)

이공계 논문의 종류

- Communication, Letters (속보)
- Regular Article (일반논문)
- Note (단신)
- Review (총설)
- Thesis(석사학위논문)/Dissertation(박사학위논문)

Cf. 특허 (patent), 연구보고서 (report)

***Report**는 기본적으로 평가자의 기준에 부합되게 작성되어야 함

종류	평가자
Paper	동료 연구자 (Peer)
Thesis	지도교수, 심사위원
Patent	변리사
연구보고서	연구비 제공처, 평가위원

Communication (단신)

J|A|C|S
COMMUNICATIONS

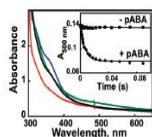
A Long-Lived, Substrate-Hydroxylating Peroxodiiron(III/II) Intermediate in the Amine Oxygenase, AurF, from *Streptomyces thioluteus*

Victoria Komeeva Korboukh,^{1,2} Ning Li,² Eric W. Barr,² J. Martin Bollinger, Jr.,^{*,1,2} and Carsten Krebs^{*,1,2}

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Received August 1, 2009; E-mail: ckrebs@psu.edu; jmb21@psu.edu

AurF from *Streptomyces thioluteus* utilizes O₂ as oxidant to effect the six-electron oxidation of *p*-aminobenzoate (pABA) to *p*-nitrobenzoate (pNBA), a building block of the antibiotic aureothin.¹ This conversion entails three successive two-electron oxidations via *p*-hydroxylaminobenzoate (pHABA) and *p*-nitrosobenzoate intermediates.^{2,3} Sequence analysis and the crystal structure of AurF showed that it has a carboxylate-bridged dinuclear metal center, which was presumed to activate O₂ for the oxidation reactions. Following initial controversy



COMMUNICATION

www.rsc.org/chemcomm | ChemComm

White-light phosphorescence emission from a single molecule: application to OLED†

Henk J. Bolink,^a Filippo De Angelis,^b Etienne Baranoff,^c Cédric Klein,^c Simona Fantacci,^b Eugenio Coronado,^a Michele Sessolo,^a K. Kalyanasundaram,^c Michael Grätzel^f and Md. K. Nazceuddin^{*,c}

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First published as an Advance Article on the web 23rd June 2009

DOI: 10.1039/b908946b

A simple mononuclear cyclometallated iridium(III) complex exhibits white photo- and electro- luminescence in the wavelength range from 440 to 800 nm, which originates from a single emitting excited state of mixed character.

Organic light emitting diodes (OLEDs) are recently proposed as one of the most appealing solutions for low energy consumption solid-state lighting.¹ To date organic white light-emitting devices (WOLEDs) are obtained by combining the emission from red, green and blue or sky-blue and orange emitters. The combination of these emitters can be achieved by the deposition of multiple layers on top of each other,² by mixing them into one single emitting layer,³ combinations of the two techniques,⁴ and by combining them into polymeric structures.⁵ These approaches require more complex device architectures and production processes compared to single-

hereafter labelled as N966 (Fig. 1 and SI (ESI†) for the crystal structure). The UV-Vis absorption spectrum of N966 in CH₂Cl₂ solution at 298 K displays bands in the UV at 260, 284, 308, 348 and 376 nm, and the visible region at 408 and 454 nm due to intra-ligand ($\pi\text{-}\pi^*$) and metal-to-ligand charge transfer transitions (MLCT), respectively (Fig. 1). When excited at 298 K within the ligand ($\pi\text{-}\pi^*$) and MLCT absorption bands, the N966 complex shows a broad and almost unstructured emission covering the spectral range from 440 to 800 nm, with a maximum intensity at 570 nm,⁶ a photoluminescence quantum yield (PLQY) of 0.015 and a radiative lifetime of (1.96 ± 0.1) μs over the entire spectrum (Fig. S3 and S4, ESI†). The emission spectrum is independent of the excitation wavelength. Additionally, the excitation spectrum is independent of the probed wavelength (Fig. S5, ESI†). Finally, emission spectra measured at concentrations

긴급하고 중요한 과학적 발견을 신속히 발표 함으로서 여기에 관심을 가지는 많은 연구자들이 그 결과를 응용하여 범위가 확대되고 보다 발전된 연구를 하도록 하는 목적의 논문

- 긴급성 (Unusual urgency)
- 시기적절성 (Timeliness)
- 중요성 (Significance)
- 보편적 관심도 (Broad interest)

* The criteria of urgency and significance should be included in the cover letter

* The principal conclusions be stated in the opening sentences of the manuscript

Review (총설)

Chem. Rev. 2001, 101, 2921–2990		2921
Atom Transfer Radical Polymerization		
Krzysztof Matyjaszewski* and Jianhui Xia		
Department of Chemistry, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213		
Received February 15, 2001		
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Review 는 특정한 주제나 전문 분야와 관련된 최근까지의 논문이나 저서를 망라하여 **종합 정리**, **비평하는** 것을 말함. 그러므로 Review 를 잘 이용하면 **새로운 논문에 대한 방향 설정과 자료 수집에** 도움이 됨.

Regular Article

JACS

ARTICLES

Published on Web 10/13/2005

Perforated Layer Structures in Liquid Crystalline Rod–Coil Block Copolymers

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Abstract: We report a novel observation of the tetragonal perforated layer structures in a series of rod–coil liquid crystalline block copolymers (BCPs), poly(styrene-*block*-(2,5-bis[4-methoxyphenyl]oxycarbonyl)-styrene) (PS-*b*-PMPCS). PMPCS forms rigid rods while PS forms the coil block. Differential scanning calorimetry (DSC), polarized light microscopy (PLM), small-angle X-ray scattering (SAXS), wide-angle X-ray diffraction (WAXD), and transmission electron microscopy (TEM) techniques were used to investigate these rod–coil molecules, and a perforated layer structure was observed at $f^{PMPCS} \approx 0.37$ in relatively low molecular weight (M_n) samples and ~ 0.5 in high M_n PS-*b*-PMPCS. This substantial phase boundary shift was attributed to the rod–coil nature of the BCP. The perforation obeys a tetragonal instead of hexagonal symmetry. The “onset” of perforation was also observed in real space in sample PS₁₇₁-*b*-PMPCS₃₂ ($f^{PMPCS} \approx 0.52$), in which few PS chains punctuate PMPCS layers. A slight increase in f^{PS} , by blending with PS homopolymer,

bilayer Sm_A phase was thus proposed.⁵²

In this paper, we report our observation of a perforated layer (PL) structure in both low M_n asymmetric and high M_n symmetric PS-*b*-PMPCS BCPs where the PS chains perforate the PMPCS layers. In these PL forming systems, PS is the major component (with $f^{PS} \approx 0.63$) in the low M_n BCPs while f^{PS} is ~ 0.5 in high M_n BCPs. More interestingly, SAXS experiments show the perforation of the PS into PMPCS layers obeys a tetragonal, instead of the conventional hexagonal, symmetry. f^{PS} was fine-tuned by blending PS-*b*-PMPCS with a lower M_n PS homopolymer, and it was found that the “degree” of perforation increased with increasing f^{PS} .

Results and Discussion

Perforated Layer Structure of PS-*b*-PMPCS. The first PS-*b*-PMPCS BCP that was investigated in this study is PS₁₇₁-*b*-PMPCS₃₂, with $f^{PMPCS} \approx 0.37$, as confirmed by NMR measurement. Phase separation of the PMPCS and the PS blocks was confirmed by DSC as shown in Figure 1. As previously reported, by introducing thermal hysteresis (slow cooling followed by fast heating), DSC heating thermograms clearly show two hysteresis peaks indicating two glass transition temperatures (T_g) at ~ 100 °C and 118 °C, corresponding to the T_g of PS and PMPCS blocks.⁵² 2-D SAXS experiments were conducted on the sheared sample to confirm the phase structure. Figure 2a and b show the 2-D SAXS patterns taken with X-ray along y and x directions as defined in Scheme 1. It is evident, from Figure 2a, that, in addition to the equator diffractions, there are four strong diffractions in the quadrants. Detailed analysis shows that these four quadrant diffractions compared to the first-order

respectively. In the case of double gyroid and hexagonal perforated layer (HPL) structures, the shearing direction is parallel to the [111] (for $Ia\bar{3}d$ space group) and $[\bar{1}210]$ (for $P6_3/mmc$ or $R\bar{3}m$ space groups) directions. Out of these four phase structures, for a single crystal-like sample, it is only in the lamellar structure that the SAXS patterns along the shearing (x) direction and the orthogonal (y) direction are identical. To obtain the in-plane symmetry of the sample, 2-D SAXS was carried out along the z direction and is shown in Figure 2c. A relatively weak diffraction ring can be seen with a d spacing of ~ 21 nm. From these SAXS results, we anticipate that the most possible structure is a PL phase, in which case PS and PMPCS form alternating layers and the “excessive” PS molecules punctuate the PMPCS layers. The in-plane symmetry, however, cannot be concluded. There are two possible reasons for the lack of orientation in the diffraction pattern along the z -direction: (1) mechanical shearing did not provide a perfect, single crystal-type structure; (2) the in-plane fluctuation is infinitely degenerated, and the diffraction pattern is intrinsically isotropic, as suggested by Laradji et al.⁵³

To further confirm the PS₁₇₁-*b*-PMPCS₃₂ structure in the real space, TEM experiments were conducted on thin, ultramicrotomed films. RuO₄ was used to stain the thin BCP sections to enhance the contrast. Figure 3 shows the TEM micrographs of such films. The samples were microtomed normal to y , x , and z directions in Figure 3a, b, and c, respectively. It is evident from both Figure 3a and b that layer structures are formed with alternating dark (PMPCS) and light (PS) areas. It is interesting to observe that the dark areas are not continuous layers. Careful examination shows that these dark layers are formed by discrete

(52) Li, C. Y.; Tenneti, K. K.; Zhang, D.; Zhang, H.; Wan, X.; Chen, E. Q.; Zhou, Q. F.; Avila-Orta, C.; Igors, S.; Hsiao, S. *Macromolecules* 2004, 37, 2854–2860.

(53) Laradji, M.; Shi, A. C.; Noolandi, J.; Desai, R. C. *Macromolecules* 1997, 30, 3242–3255.

일반논문은 초록, 서론, 실험방법, 결과 및 토론, 결론, 참고문헌 등의 보편적인 형식을 갖춘 것으로서 깊고 상세한 관찰과 토론을 포함한 완성도가 높으며 대부분의 논문을 차지함

* Note (단신) : 창의적이면서 중요한 단편적인 연구 결과

2. 표절의 기준과 올바른 인용법

표절 (Plagiarism)의 정의 ; 다른 사람이 창작한 저작물의 일부 또는 전부를 **도용**하여 사용하여 자신의 저작물인 것처럼 발표하는 것

인용 (quotation) ; 다른 사람의 자료나 글을 사용하는 것

* 표절과 인용의 가장 큰 차이점 → **출처**를 알렸는지 아닌지 하는 점

* **표절의 개념** : 타인의 기존 아이디어, 과정, 결과, 표현 등을 **원작자와 출처**를 밝히지 않고 재사용하는 것

2008년 교육인적자원부에서 마련한 논문 표절 가이드라인

1. 여섯 단어 이상의 **연쇄표현**이 일치하는 경우
2. 생각의 단위가 되는 명제 또는 **데이터가 동일하거나 본질적으로 유사한** 경우
3. **타인의 저작물을 자신의 것처럼** 이용하는 경우
4. 남의 표현이나 아이디어를 **출처표시 없이** 쓰거나 창작성이 인정되지 않는 **짜깁기**
5. 연구결과 **조작** 및 저작권 침해 가능성이 높은 저작물

2. 표절의 기준과 올바른 인용법

자기표절 ;

• 자신의 저작이라 하더라도 출전을 밝히지 않고 상당 부분을 그대로 다시 사용하는 경우. 예를 들면, 같은 논문을 거의 그대로 다른 학술지에 게재하는 경우 (타국어 사용 포함)

1. 그림, 표, data, 등이 동일한 경우
2. 원전 (특히, 결과 및 토론과 결론 부분)과 연속된 5문장 이상 같거나, 동의어가 거의 같은 순서대로 나열되는 경우.

자기 표절 판단기준 실예 : 논문을 2개소 이상 게재 시, 유사성 정도가 대조문헌 간에 세계전기전자학회(IEEE)는 25% 이상, 세계컴퓨터협회(ACM)는 70% 이상 동일시 → 자기표절

* 연구물 : 학술대회발표문, 연구용역보고서, 학위논문 등
ISBN 붙지 않은 발표물을 학술지에 게재하는 경우 → 표절 아님

2. 표절의 기준과 올바른 인용법

올바른 인용법 ;

자신의 연구의 독자성을 해하지 않는 범위 내에서 타인의 연구 아이디어, 연구 데이터 및 문장을 부분적으로 사용할 수 있음. 다만, 이 경우에는 정확한 출처 표시 또는 인용표시를 하여야 함

Reference 표

- 인용내용 자체 또는 저자의 성과 함께 기술하며, 인용논문의 저자에 따라 다음과 같이 표기하고 문장 끝에 인용번호를 붙임.
 - 1인: **Grubb** found that cyanide inhibits enzymes. [1]
 - 2인 : These data support the conclusions of **Grubb and Jones** .[2]
 - 3인 이상 : As early as 1987, **Johnston et al.** observed the inhibitory effect of cyanide on enzyme action. ³
 - 본인논문: We previously reported that [4]

정확한 인용표시에도 불구하고 표절 의심 행위

독자성이 없을 정도로 많은 양의 타인의 연구성과 또는 그 재구성에 의존한 논문. 다만, 리뷰논문(review article)과 같이 학계의 연구동향을 소개, 정리 또는 평가하는 경우는 제외.

3. SCI 등 국내외 논문 체계 및 분류

국내 학술지 종류

- 연구재단 등재 후보지; 493 종 (2013년 현재)
- 연구재단 등재지; 1,635종 (2013년 현재)

연구재단 등재 후보지;

한국연구재단에서 매년 정해진 기준과 심사위원단에 의하여, 신청된 학술지를 평가하여 일정점수 이상일 때 선정

연구재단 등재지;

한국연구재단에서, 등재후보지에 대하여 정해진 기준과 심사위원단에 의하여 평가하여 일정 점수 이상일 때 선정

→ 2015 부터 등재(후보)지 없어지고
“한국연구재단에 등록된 학술지”로 변경,
약 4,000종 등록 예상

SCI 등 국내외 논문 체계 및 분류



국제학술지 종류

SCI (Scientific Citation Index) : '11년 현재 3,757종

SCIE (SCI-Expanded) : '11년 현재 8,621종 (SCI 포함)

SCOPUS; 18,000 여종

- SCI, SCIE ← ISI (Institute of Scientific Information): 1960년 미국의 사설기관 으로 출발하여, 현재는 Thomson Reuter 사에서 국제적인 논문을 평가하고 정보를 제공함
- SCOPUS ← ELSEVIER사가 제공하는 과학 · 기술 · 의학 · 사회과학 분야를 포함하는 세계 최대 규모의 초록 · 인용 데이터베이스
- Impact Factor : 최근 2년간 게재된 논문들의 평균 인용횟수
Ex) 2012 impact factor =
2010,2011년에 해당저널에 출판된 논문이 2012년에 피인용된 횟수/2012년에 해당저널에 실린 논문 수

SCI 등 국내외 논문 체계 및 분류

Scopus

포괄적인 검색, 최신 학술문헌 정보에 접근, 인용 분석을 제공하며, 연구자와 기관의 연구 활동 평가 등 오늘날의 연구환경에서 요구되는 기능을 한꺼번에 제공

Scopus 수록 내용

5,000여 출판사에서 발간하는 약 18,000여종의 Peer-reviewed 학술정보

- 17,000 peer-reviewed journals, 350 book series, Conference proceedings

검색결과 요약 정보	저널, 저자, 출판연도, 주제, 기관분석 등의 기준으로 분류
참고문헌 및 피인용 문헌 제공	피인용 정보를 통한 관련 있는 논문 파악 용이
Citation Overview	연도별 피인용 분석
다양한 논문 반출 형식	EndNote, RefWorks, Excel 형식으로 제공
저자정보	특정 연구자의 연구현황 정보 제공
기관정보	특정 기관의 연구현황 정보제공
최신 정보 제공	검색어, 인용정보의 Email, RSS Feed 알림서비스 제공
저널분석	저널 간의 다양한 기준으로의 비교 분석

SCI 등 국내외 논문 체계 및 분류

다양한 연구활동에서의 Scopus 활용 예

연구:

다량의 최신정보 입수
동분야 과학자 조사

연구비신청:

연구테마의 관련정보 파악
논문과 피인용 정보 조사

논문투고:

논문작성 정보수집
저널 조사

논문심사:

논문심사자 선정
참고문헌 조사

4. 논문의 구성과 작성법 - 제목

; 자체의 **Template**를 제공하는 **Journal** 이 많기 때문에 이에 따라 작성하면 편리

Transparent, Conductive Carbon Nanotube Films

Zhuangchun Wu,^{1,*} Zhihong Chen,^{1,*†} Xu Du,¹
Jonathan M. Logan,¹ Jennifer Sippel,¹ Maria Nikolou,¹
Katalin Kamaras,² John R. Reynolds,³ David B. Tanner,¹
Arthur F. Hebard,¹ Andrew G. Rinzler^{1‡}

We describe a simple process for the fabrication of ultrathin, transparent, optically homogeneous, electrically conducting films of pure single-walled carbon nanotubes and the transfer of those films to various substrates. For equivalent sheet resistance, the films exhibit optical transmittance comparable to that of commercial indium tin oxide in the visible spectrum, but

efficiency (4). Our t-SWNT production process is quite simple, comprising three steps: (i) vacuum-filtering a dilute, surfactant-based suspension of purified nanotubes onto a filtration membrane (forming the homogeneous film on the membrane); (ii) washing away the surfactant with purified water; and (iii) dissolving the filtration membrane in solvent (4). Multiple techniques for transfer of the film to the desired substrate have been developed. The films can be made free-standing over appreciable apertures ($\sim 1 \text{ cm}^2$) by making the transfer to a substrate with a hole, over which the film is laid before membrane dissolution (5, 6).

• 논문 제목 작성 요령

- 제목과 초록은 논문작성의 **마지막에** 완성하는 것이 좋음
- 제목은 **간단하지만** 종합적이고 **구체적인 표현**이 될 것
- **약어**를 사용하지 않으며, **콜론 같은 기호**의 사용을 지양할 것
(예외: 독자에게 널리 알려진 약어, PMMA 등)

4. 논문의 구성과 작성법 - 제목

잘못된 제목의 예 (examples)

“The preparation of carbon nanoparticles as a filler for polymers” (X)

→ “The preparation of carbon nanoparticles as a filler for polyethylene (실제로 사용했던 물질)” (O)

“in a gas pressure atmosphere” (X) → “in high pressure argon” (O)

“The synthesis of carbon nanotubes using a xxxx catalyst; the effect of the catalyst preparation method” (X) → “The effect of the catalyst preparation method on the synthesis of carbon nanotubes using a xxxx catalyst” (O)

4. 논문의 구성과 작성법 - 저자

저자 (Author and affiliation)

Transparent, Conductive, and Flexible Carbon Nanotube Films and Their Application in Organic Light-Emitting Diodes

Daihua Zhang,^{†,§} Kounghmin Ryu,^{†,§} Xiaolei Liu,[†] Evgueni Polikarpov,[‡] James Ly,[‡]
Mark E. Thompson,[‡] and Chongwu Zhou^{*,†}

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University of Southern California, Los Angeles, California 90089*

Received April 16, 2006; Revised Manuscript Received June 21, 2006

- 일반적으로 저자이름은 논문제목 아래에 기재함.
- 저자가 여러 사람일 경우에는 실험과 논문을 수행한 주된 저자의 이름을 먼저 쓰고 논문에 기여한 정도에 따라 순서대로 저자의 이름을 적음 → 제1저자가 중요
- 저자이름의 다음 줄에 저자의 소속 기관명을 차례로 적음. 저자의 이름 위에 기호(a, b, ‡, # 등)을 붙이고 아래에 소속을 밝히거나 각주에서 소속을 밝히는 경우도 있음
- 교신저자 (corresponding author) 는 실험 및 논문 지도와 투고한 지도교수로서 통상 이름 위에 * 를 붙이고 각주에 연락처 (e-mail) 를 명기함

4. 논문의 구성과 작성법 - 초록

초록 (Abstract)

Received April 16, 2006; Revised Manuscript Received June 21, 2006

ABSTRACT

We have carried out comparative studies on transparent conductive thin films made with two kinds of commercial carbon nanotubes: HiPCO and arc-discharge nanotubes. These films have been further exploited as hole-injection electrodes for organic light-emitting diodes (OLEDs) on both rigid glass and flexible substrates. Our experiments reveal that films based on arc-discharge nanotubes are overwhelmingly better than HiPCO-nanotube-based films in all of the critical aspects, including surface roughness, sheet resistance, and transparency. Further improvement in arc-discharge nanotube films has been achieved by using PEDOT passivation for better surface smoothness and using SOCl_2 doping for lower sheet resistance. The optimized films show a typical sheet resistance of $\sim 160 \, \Omega/\square$ at 87% transparency and have been used successfully to make OLEDs with high stabilities and long lifetimes.

Evaluating the potential of carbon nanotubes (CNTs) as the basis of future nanoelectronics technology has been the subject of intense research since their discovery. In contrast, their applications in macroelectronics had received limited

In parallel with the research efforts on the CNT-polymer mixtures, continuous CNT films^{10,11} could offer a new class of transparent conducting materials that complements indium-tin oxide (ITO) for certain niche applications, includ-

초록은 웹사이트에 서 무료로 제공되는 가장 중요한 부분으로 제목 보다 상세한 표현임 (**concise and precise !**)

→ 따라서, 본문 없이 독립적으로 읽어도 논문 전체를 이해할 수 있는 대표적인 내용이 되어야 함 → 하나의 절(단락) (one paragraph)로 작성

4. 논문의 구성과 작성법 - 초록

- 초록에 꼭 필요하며 동시에 이것으로 충분한 내용 →

“what was done” and “important results obtained” !!!

- 포함되지 않아야 할 내용 : history, 개론 , 결과의 토의 (discussion of results)

- 사용되지 않아야 할 문장 예:

“The material may be useful in capacitors”, “We think the effect is caused by---”,

“The aim of this work was to ...”, “detailed”, “careful”, “successfully” “also”,

“moreover”, “furthermore” and “in addition”, 등

- 잘못된 예:

“In this paper we report a new method for the production of carbon foams from”

→ “Carbon foams were produced from...” (O)

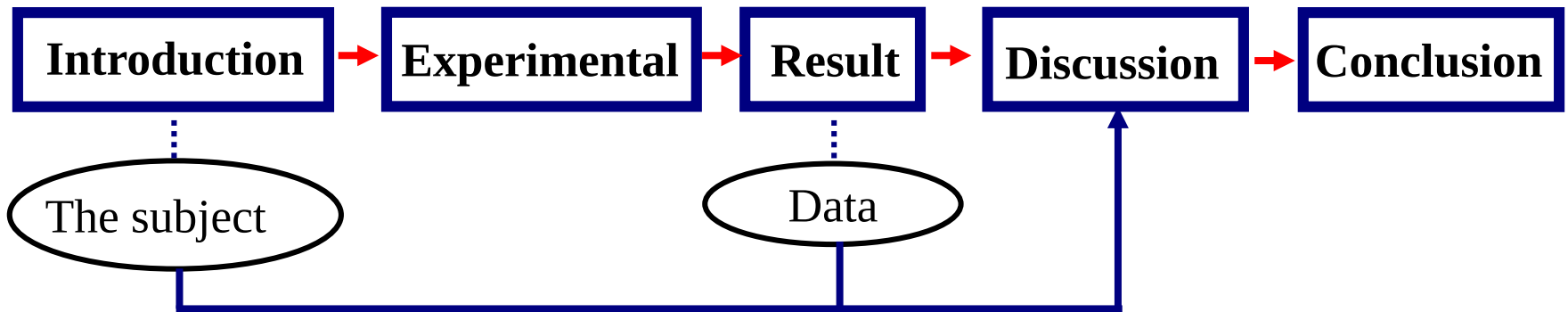
“A detailed examination of the Raman spectra shows that. . .” → “The Raman spectra show that. . .

- 약어나 참고문헌을 달지 않음 (no abbreviation and no reference)

4. 논문의 구성과 작성법 - 본문

☞ 본문의 구성 (organization of Text)

- 서론 (*Introduction*) : 왜 연구를 하였는가? (why)
- 실험 방법/재료 및 분석방법 : 무엇을 어떻게 했는가? (how)
(*Materials, methods, characterization*)
- 결과 (*Result*) : 무엇을 찾았는가? (what)
- 토의 (*Discussion*) : 그 결과는 무엇을 의미하는가? (so what)
- 결론 (Conclusion or Summary)



4. 논문의 구성과 작성법 - 본문

서론 (Introduction)

Keywords: 1H,1H-Perfluorooctyl methacrylate; Polymer micelle; Semifluorinated copolymer

1. Introduction

Semifluorinated block and graft copolymers are of growing interest because of their unique properties, such as very low surface energy and oil/water repellence [1]. They may be utilised in many applications for example, as surfactants for polyurethane foams [2] and as emulsifiers in liquid and supercritical carbon dioxide [3]. Although water-in-carbon dioxide (W/C) emulsions have been formed with perfluoroether surfactant and silicone based surfactants [4], they have not been reported with fluoromethacrylate polymers. These emulsions are of interest in environmentally benign solvent formulations for separations, polymerisations [5] and in material synthesis.

Several attempts have been reported to prepare semifluorinated copolymers by means of cationic [6], anionic

[7], living radical [8], and group transfer polymerisation [9], but few studies have addressed the synthesis of block copolymers composed of a hydrophilic block and a semifluorinated block [10,11]. The limited number of studies may be attributed to the limited solubility of fluorinated polymers in common organic solvents and the limited mechanisms by which the fluorocarbon monomer can be polymerised.

Controlled free radical polymerisation techniques provide the best route for the preparation of these amphiphilic block copolymers due to the relative ease of synthesis and their compatibility with a wide range of solvents [12,13]. Specifically, atom transfer radical polymerisation (ATRP) is an attractive method for the synthesis of well-defined copolymers with controlled molecular weight, polydispersities, terminal functionalities, and chain architecture composition [13,14].

- 기존에 연구된 내용의 범위에서 과제와 관련된 것을 정리하여 기술하는 부분이지만, 보다 중요하게는 해당 연구를 촉구하게 된 가설 (전제) 을 기술함 (찾아보고하고자 하는) 연구를 도입하는 출발점으로 맞춤
- 기존 정보로부터 해당과제의 흥미로운 측면을 도출하여 제시 (why the topic is interest)
 - 문제점의 성격과 기존 지식이나 이해의 현황을 기술
 - 연구의 동기와 중요성, 범위와 조사방법이 포함됨 (motivation for and import of the work, purpose, scope and general method of the study)
 - 가설과 예측이 기술됨 (hypothesis and prediction)

4. 논문의 구성과 작성법 - 본문

서론 (Introduction) 의 흐름

1) 알려진 사실로부터 의문점을 유추함

▶ 현재완료시제[또는 과거시제]+that+현재시제를 사용. 미래시제 사용하지 않음

(예) **Galileo reported that the earth turns round the sun.**

2) 의문점을 구체적으로 제시함

3) 연구의 새로운 점이 무엇인지를 명시함

4) 마지막으로 연구의 목적을 기술.

과거시제를 주로 사용하며, 가끔 현재시제를 사용.

(예) **The aim of this study was [또는 is] to evaluate the long-term results of the surgical procedure.**

This study investigates the relationship between tree density and fruit size

The purpose of this study is to determine the effect of enzyme concentration on ---

5) 가설(hypothesis)은 어떤 관찰에 대하여 제시된 설명이며 그것이 맞는 조건에서의 결과의 추측이 수반됨

(예) **If competition lowers reproductive output, then fruit size should be smaller when tree density increases.**

4. 논문의 구성과 작성법 - 본문

서론 기술 요령

- 일반적으로 인용한 논문의 제목 등은 본문에 쓰지 않고, 인용된 내용 끝에 숫자로 표기하며, 그 내용은 **참고문헌 리스트**에 순서대로 기록.
- 교과서처럼 방대한 내용으로 쓰지 말고 논문과 **직접 관련되는 참고문헌** 만 review 하여 가능한 **짧게** 쓰는 것이 바람직함. 많은 참고문헌들은 뒷부분의 **결과, 토론** 부분에 활용하는 것이 좋음
- 가장 **최신 참고문헌들을** 조사하여 인용함
- 긴 명칭은 약어로 적으며, 전체명칭은 맨 처음 나오는 부분에 한번만 사용한다.

[예] **For poly(dimethyl siloxane)-*b*-poly-(methacrylic acid) (PDMS-*b*-PMA), the hydrophilic anchor does ---**

4. 논문의 구성과 작성법 - 본문

연구 방법 (Theory and experimental)

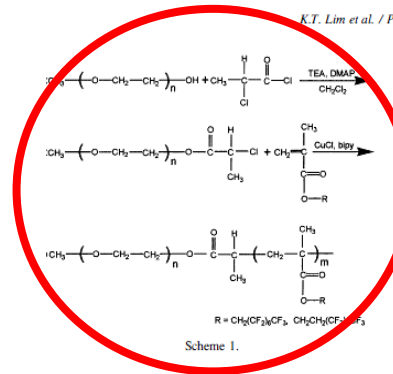
2. Experimental

2.1. Materials

2-Chloropropionyl chloride (CPC) (Aldrich) was distilled under vacuum. Triethylamine (TEA) (Aldrich) was refluxed with *p*-toluenesulfonyl chloride and distilled. It was distilled again over CaH₂. 4-Dimethylamino pyridine (DMAP) (Aldrich) was recrystallised from toluene. MMA (Aldrich), DHFOMA (SynQuest), and THFOMA (SynQuest) were passed through a neutral alumina column to remove the inhibitor, stored over CaH₂ and then vacuum distilled before use. Methoxypolyethylene glycol 2000

mixture to room temperature, the product was precipitated into ether, collected, and dried. The polymer was then diluted in chloroform/F-113 mixed solvent, filtered, and passed through a short column filled with activated Al₂O₃ to remove the catalyst. The crude product was extracted with fluorinated solvent (FC-5080) at room temperature for possible removal of PFOMA. The residue was extracted three times with distilled water in order to remove any unreacted PEG macroinitiator. The purified product was dried in vacuum at room temperature and weighed.

Samples were removed periodically for conversion and molecular weight analysis. The conversion of double bonds and the relative block length was determined by ¹H NMR obtained from unprecipitated samples.



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μ_2/Γ^2 , where μ_2 is the second cumulant of the decay function and Γ is the average characteristic line width.

2.4. Interfacial tension measurement

The interfacial tension of the ternary system (polymer/supercritical carbon dioxide/water) was measured using a high pressure pendant drop apparatus [18]. Using the apparatus, drops of water were formed at the end of a surface modified silica capillary (Western Analytical Products) with a 183 μ m o.d. and a 99 μ m i.d.

2.5. Emulsion formation

The procedure and apparatus as described by Psathas et al. [18] was used to prepare the 50:50 (by mass) water and

• 실험 섹션 (experimental section) 의 목적은

1. 독자가 원할 때 , 즉 의심스러운 결과를 **대조**하고자 하거나 **후속연구**를 위하여 **동일한 샘플**을 만들고자 할 때, **재현**할 수 있게끔 **자세한 정보**를 주고,
2. 독자들에게 해당 연구가 **적절한 장치**를 사용하여 **체계적으로** 철저히 수행되었다는 것을 보여주는 것임.

- 따라서, 제3자가 실험을 **재현**할 수 있도록 모든 정보가 망라하여야 하며, 사용한 **재료 및 출처, 순도, 입자크기, 제조 및 분석 방법, 반응조건 (온도, 시간), 장비를 상세히 기술함**. 또한 전압, 파장, 등과 같은 **분석 과 측정기술의 중요한 실험 조건**도 제공해야 함.

4. 논문의 구성과 작성법 - 본문

연구 방법 (Theory and experimental)

- 실험섹션도, 앞서 언급한 목적을 충분히 달성하는 수준에서, **가급적 짧게** 기술하며, 크게 중요하지 않은 실험 내용과 장비 목록은 **Supplementary Material** 섹션에 포함함.
- 연구(실험)가 진행된 순서에 따라 혹은 연구 내용의 형태에 따라 기술함.
- **International System of Units (SI Unit)**을 사용함 [예] m, kg, mL, °C, Pa
- 시약은 출처와 순도(규격)와 처리방법을 기술함
[예] **Collagenase P (P-5417, Sigma Chemical Company) was used as received.**
- 실험에 사용된 **매우 위험한** 재료, 장비, 제조방법 등은 분명히 **명시함**.
- 실험기계 등은 모델명, 제작회사명 등을 기입함.
[예] **DSC data were obtained using a DSC-60 thermal analysis system (Shimadzu Corporation)**
- 과거시제로 기술한다 : 일반적으로 영문논문은 수동태, 국문논문은 능동태로 기술함.

4. 논문의 구성과 작성법 - 본문

SI Unit의 사용법

- 멱지수(Exponent) : sq m $\rightarrow$ m² cu m $\rightarrow$ m³
- 복수형 : 70 **Ls (X)** $\rightarrow$ 70 **L (O)**
- 주어-동사 일치법 : 집합명사이므로 단수동사를 필요로 함

Seventy-five milligrams of lidocaine was administered on admission.

- Beginning of sentence, title, subtitle : 약어 사용 못함

Sixty-five milligrams of amoxicillin was given 20 minutes later.

물리량	단위기호
길이	m
체적(부피)	m ³ / L
시간	s
온도	K / °C
질량	Kg
물질의 양	mol
압력	Pa / bar

4. 논문의 구성과 작성법 - 본문

연구 방법 (Theory and experiment)

- 수학적 방법에 고찰되는 **수식과 통계검사는** 실제 **실험연구와 함께** 기술한다
- 새로운 물질은 NMR, 원소분석 결과와 같은 **확인 data와 순도가** 제공되어야 한다
- **약품의 명명법은** CAS 와 **IUPAC** 에 따른다.

(<http://www.iupac.org/publications/books/author/metanomski.html>

<http://www.iupac.org/reports/IV/guide.html>)

- **등록된 상표명은** 언제나 **대문자**로 씀. (예, a Teflon coated spin bar)
- **잘 알려진 제조법은** 간단히 인용 한다.

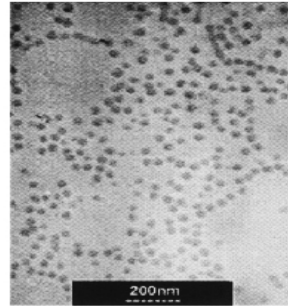
예: **The compound was prepared according to the previous work. [1]**

The chromosomes were counted at meiosis in the anthers with the standard acetocarmine technique of Snow.[2]

- **Hyphen** : 형용사로 쓰일 때 사용한다. a 10-cm visual analogue scale
- **Spacing** : 숫자와 단위 사이에 **full space**를 띄운다 . 140 mg , 75 mL
(예외) percent, 각도, °C 은 붙여 쓴다: 45% 45° 37.5°C
- 범위를 표시할 때 **단위는 뒷 숫자에만** 붙인다 (예) 2~8 g [예외] 2%~8%

4. 논문의 구성과 작성법 - 본문

결과 (Result)



(A)

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in the copolymer to some extent. For most of the block copolymers, no micelles were formed in the mixed solvent of 0.1–0.3 weight fraction of chloroform. This was also verified by ^1H NMR which showed well-resolved signals for two blocks in the solvent composition range.

Fig. 2 depicts the TEM images of the micelles of $\text{PEO}_5\text{-}\kappa\text{-b-PDHFOMA}_{4.5\text{-}\kappa}$ and $\text{PEO}_5\text{-}\kappa\text{-b-PDHFOMA}_{12.5\text{-}\kappa}$. The dark core regions correspond to the PDHFOMA in accordance with the higher electron density of the fluorinated block. It is shown in Fig. 2(A) that the micellar images of $\text{PEO}_5\text{-}\kappa\text{-b-PDHFOMA}_{4.5\text{-}\kappa}$ are predominantly spherical. The average diameter of cores was calculated as ca. 24 nm. For the higher PFOMA block copolymer of $\text{PEO}_5\text{-}\kappa\text{-b-PDHFOMA}_{12.5\text{-}\kappa}$, primarily rod-like aggregates are formed (Fig. 2(B)). The micrograph suggests a narrow size distribution of the cylindrical micelle diameter, but a widely variable length. Several small spheres were also observed. The rods and spheres have a similar diameter of

Results and Discussion 은 논문에서 가장 중요한 섹션임

1. 데이터를 분명하게 제시해야 함 (graph > table)
2. 결과는 상식적으로 이치에 맞아야 함. (ex. an improved yield of 7474%)
3. 주관적인 것과 절대적인 것을 분별해야 함 (ex. TEM 사진 해석)
4. 지나친 외삽은 금물임 (data points는 4점 이상, 결과 분석을 다양한 변수 필요)
5. 토론은 체계적으로 이루어져야 함 (논리적인 방식으로 연구 결과로부터 결론으로 도달해야 함)
6. 참고 문헌 등 다른 사람 논문을 잘 읽고 배우는 것이 좋은 논문 작성에 필수적임

4. 논문의 구성과 작성법 - 본문

결과 (Result)

- Data를 기술하는 순서는 연구가 **진행된 순서로** 할 수도 있고, 중요한 data 부터 덜 중요한 data순서로 할 수도 있음.
- **Data의 나열은** 본문에서 **최소한으로** 기술하고, 대부분의 data는 figure나 table에 넣음.
- 모든 결과가 **설명**되어야 하고, 본문의 서술은 figure나 table에 있는 결과에 의해 지지되어야 함.
- 본문은 figure나 table에 상관없이 자체로 독자에게 이해가 될 수 있어야 함

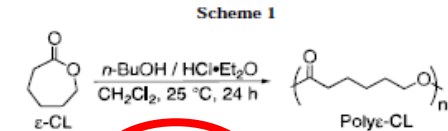
(예) **The results are given in Figure 1 (X)** → Temperature was directly propotional to metabolic rate (Figure 1) (O)

- 모든 결과에 대해 그 ‘연구 재료와 방법’이 기술되어 있는지를 확인함.

4. 논문의 구성과 작성법 - 본문

고찰(토의) (Discussion)

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Publication Date



Results and Discussion

Ring-Opening Polymerization of $\epsilon\text{-CL}$ with n -Butyl Alcohol/HCl·Et₂O Initiator System. As described in the Introduction, we have recently reported that the ring-opening polymerization of 1,3-dioxepan-2-one (7CC) by H₂O or a primary alcohol in the presence of HCl·Et₂O satisfactorily proceeds to give linear poly7CC with the controlled M_n (10^3 – 10^4) and narrow M_w/M_n (~ 1.15) without side reactions such as decarboxylation.⁶ The key feature of this polymerization may be the acidity of the added protonic acid, which is not as large to polymerize the monomer by itself but is sufficient to activate the monomer. To extend this facile method to cyclic esters, we performed the ring-opening polymerization of $\epsilon\text{-CL}$ to examine the M_n and M_w/M_n of the polymer. Scheme 1 and Table 1 summarize the results of the polymerization of $\epsilon\text{-CL}$ with n -butyl alcohol ($n\text{-BuOH}$) in the presence of HCl·Et₂O. Although the polymerization did not proceed with n -butyl alcohol alone (run 1), the addition of HCl was quite effective to give poly $\epsilon\text{-CL}$ quantitatively (runs 2–6). The increase

polymer seriously, and the M_w/M_n ratio was small (runs 2 and 3). These results suggest that HCl did not serve as an initiator, but an activator in this system, similar to the polymerization of 7CC. The M_n value agreed well with that calculated from the feed ratio of the monomer to initiator in every sample, keeping a narrow polydispersity ratio (runs 2 and 4–6).

Figure 1 illustrates the ¹H NMR spectrum of poly $\epsilon\text{-CL}$ obtained by the polymerization of $\epsilon\text{-CL}$ with 1/10 equiv of $n\text{-BuOH}$ /HCl initiator system in CH₂Cl₂ at 25 °C for 5 h (initial concentration of $\epsilon\text{-CL}$, [$\epsilon\text{-CL}$]₀ = 1 mol/L). In addition to signals *b–f* assignable to α -, β -, γ -, δ -, and ϵ -methylene protons of the ester carbonyl moiety at 2.31, 1.65, 1.39, 1.65, and 4.06 ppm, signals *a* and *g* on the basis of terminal methyl and α -methylene proton signals of a hydroxyl group were observed at 0.94 and 3.65 ppm, respectively. The integration ratio of the signals *a* to *g* was exactly 3/2, which agreed with the expected value.

Figure 2 illustrates the dependence of M_n and M_w/M_n of poly $\epsilon\text{-CL}$ on the feed ratio [$\epsilon\text{-CL}$]₀/[$n\text{-BuOH}$]₀ in the polymerization in CH₂Cl₂ at 25 °C. The M_n increased almost linearly with increasing the feed ratio of the monomer to initiator, keeping narrow polydispersity. The second-feed experiment to confirm the living nature of the polymerization was examined. First, $\epsilon\text{-CL}$ was polymerized with 1/40 equiv of $n\text{-BuOH}$ /HCl·Et₂O initiator system in CH₂Cl₂ at 25 °C for 12 h. After confirming the quantitative monomer conversion, the same amount of monomer was fed into the polymerization

- 이부분에서는 **Data를 분석하고** 다른연구와의 관련성을 서술함.
즉, 원래의 의문점이나 가설의 관점에서 실험 결과의 의의를 평가함
- 결과와 원래 가설사이의 **상관관계** 기술
 - 결과가 가설을 증명하는지, 반박 또는 수정이 필요한지
 - 연구결과와 합치되는 **참고문헌**을 제시 설명.

(예) Results of the present study correspond with the earlier study which reported that tinnitus is significantly alleviated by surgery. [1]

4. 논문의 구성과 작성법 - 본문

고찰(토의) (Discussion)

- 기존의 연구보고와의 **차이점**을 설명함.
 - **These findings are in contrast to the results of Rimell et al. [2]**
- 연구결과의 **새로운 점과 중요성**을 지적함.
 - **prove (입증하다) > demonstrate, document (제시하다)**
 - > **show, indicate (제시하다) > suggest, imply, speculate, suppose, assume, extrapolate, infer, inspire, presume, postulate (시사하다, 추정하다, 추론하다)**
- **예기치 않은 결과가** 있으면 설명하고 고찰함.
- 서론에서 사용한 동일한 내용의 문장, 비슷한 의미를 갖는 문장을 **반복하지 않음.**
- **Data**와 결과에 대한 자세한 설명을 **반복하지 않음.**
- 최근에는 **Result** 부분과의 총체적인 서술과 중복성을 회피하기 위하여 **Results and Discussion** 으로 합쳐서 기술하는 경우가 많음
- 저자 (**We** 또는 **The authors**)는 이따금 사용하는 것은 좋으나 너무 자주 사용 하지 않음.

4. 논문의 구성과 작성법 - 본문

결론 (Conclusion or Summary)

K.T. Lim et al. / Polymer 43 (2002) 7043–7049

face for PEO₅ K-b-

γ (mN/m) DI H ₂ O
4.40
4.48 ^a
4.91 ^b
5.11 ^c
6.52

4. Conclusions

Amphiphilic block copolymers consisting of a hydrophilic PEO block and semifluorinated PFOMA block were synthesised using PEO macroinitiators containing chain ends with ATRP function. It has been demonstrated that PEO macroinitiators polymerise DHFOMA and THFOMA effectively with controlled molecular weights. The block copolymers formed stable micelles, where PEO is the shell,

- 1) 연구결과로부터 연구목적(가설)을 이론적으로 검증하는 단계인 [고찰]을 거쳐 마지막으로 **맺음을 하는 부분임**. 따라서 저자의 연구성과에 바탕을 둔 것이어야 함.
- 2) 흔히 범하는 잘못된 연구결과를 반복해서 제시하는 것임. 구체적인 수치나 data를 **나열하지 않음**.
- 3) 도출한 결론에 입각하여 **향후의 연구방향, 기대효과**를 부언할 수 있음.
- 4) 문장은 **초록과 중복되지 않도록** 작성.
- 5) 결론 문장은 현재시제로 기술될 수 있음 : 영문 논문에서는 가능성을 나타내는 조동사를 **that절** 안에 흔히 사용함.

can > will > would > should > may (50%의 가능성) > could > might

It is suggested that humoral autoimmunity may play a significant role in the pathogenesis of atherosclerosis in diabetes.

4. 논문의 구성과 작성법 - 본문

참고문헌 (Reference)

1. Introduction

Semifluorinated block and graft copolymers are of growing interest because of their unique properties, such as very low surface energy and oil/water repellence [1]. They may be utilised in many applications for example, as surfactants for polyurethane foams [2] and as emulsifiers in liquid and supercritical carbon dioxide [3]. Although water-in-carbon dioxide (W/C) emulsions have been formed with

3.4. Interfacial activity

The results from an interfacial tension study for PEO₅K-*b*-PDHFOMA_{7.5}K are summarised in Table 3. These results illustrate the dependence of the interfacial tension on the temperature, pressure, salinity, and CO₂ density. The surfactant concentration was 0.05 wt%.

The binary water-CO₂ interfacial tension is approximately 20 mN/m in the range investigated. The addition of surfactant lowered the interfacial tension enough for the

[7], living radical [8], and group transfer polymerisation [9], but few studies have addressed the synthesis of block copolymers composed of a hydrophilic block and a semifluorinated block [10,11]. The limited number of studies may be attributed to the limited solubility of fluorinated polymers in common organic solvents and the limited mechanisms by which the fluorocarbon monomer can be polymerised.

Controlled free radical polymerisation techniques pro-

References

- [1] Kissa E. Fluorinated surfactants. New York: Marcel Dekker, Inc; 1994.
- [2] Krupers AB, Burchard GF, Goh SH, Hsiao BM. *Macromol. Rapid Commun.* 1998; 19(10):2049-53.
- [3] Kendall JL, Canelas DA, Young JL, DeSimone JM. *Chem Rev* 1999; 99(2):543-63.
- [4] Psathas PA, da Rocha SRP, Lee Jr. CT, Johnston KP, Lim KT, Webber SE. *Ind Engng Chem Res* 2000;39:2655-64.

- 해당잡지의 지침 (Guidelines for Authors) 에 따라 작성한다.
- 본문에 인용번호가 빠짐없이 표시되어 있는가?
- 저자가 모두 포함되어 있는가?
- 저자들의 성명 철자가 맞는가?
- 참고문헌의 제목, 구두점, 부제목 등이 맞는가?
- 참고문헌의 발행 연도, 권 (volume), 호 (issue), 페이지가 맞는가?
- 학술지 이름의 약어가 맞는가?

4. 논문의 구성과 작성법 - 본문

Tables (표):

- Table은 데이터의 정확한 숫자를 나타낼 수 있음. 간결해야 하며 text를 참조하지 않아도 data를 설명할 수 있도록 작성해야 함. 모든 table은 비슷한 형식을 가지고 있음.
- Table은 일반적으로 텍스트 내에서 순차적으로 숫자로 표시되며 table의 title은 table의 정보를 간략히 표시하여야 하며 table의 가장 위에 위치함.
- 자세한 설명은 table 하단에 위치한 footnotes에 주며, 해당부분에 이탤릭체 상첨자로 표시함.
- 가급적 data는 표로 표현하는 것 보다 그림으로 표현하는 것이 이해를 돕기 쉬움
- Table과 figure의 data가 중복이 되면 안됨

4. 논문의 구성과 작성법 - 본문

Tables (표):

- 열의 윗글은 그 열 아래에 있는 변수나 data를 나타내며 변수의 이름과 측정 단위가 포함되어있음. 열과 행의 단어나 문장 중 첫 글자만 대문자를 사용함
- Table의 body는 data를 표현함. Data 는 비슷한 요소가 같은 행의 아래쪽으로 차례로 위치함. 숫자는 행 내에서 범위(예 25 - 67) plus/minus 부호, 소수 (예 0.1) 등으로 표기됨. 특히 유효숫자에 유의함.
- Table 의 수평선들은 Table 제목, the column headings, the subheadings, the body, from the footnotes 를 나누는 역할을 한다. 주의할 점은 Table에서는 수직선을 하지 않음.
- 한글논문에도 table 및 figure의 표제 (title과 caption)는 영문으로 작성함

4. 논문의 구성과 작성법 - 본문

Table 의 예

Shaheen, Sterne, Thompson, *et al.*: Dietary Antioxidants and Asthma

1825

TABLE 2. ASSOCIATION BETWEEN ASTHMA AND FREQUENCY OF CONSUMPTION OF FLAVONOID-RICH FOODS AND DRINKS

Food/Drink	Group	n (Cases)	n (Controls)	Crude OR (95% CI)	p (Trend)	OR* (95% CI)	p (Trend)
Apples	< Once/mo	150	133	1.0		1.0	
	1-3 per mo	169	146	0.97 (0.71, 1.34)		0.96 (0.69, 1.34)	
	Once/wk	132	103	0.88 (0.62, 1.25)		0.90 (0.63, 1.30)	
	2-4/wk	228	123	0.61 (0.44, 0.84)		0.68 (0.48, 0.95)	
	≥ 5/wk	185	102	0.62 (0.44, 0.87)	0.0001	0.68 (0.47, 0.98)	0.0057
Onions	< Once/mo	104	89	1.0		1.0	
	1-3/mo	102	83	0.95 (0.63, 1.43)		1.13 (0.74, 1.72)	
	Once/wk	171	125	0.85 (0.59, 1.23)		1.02 (0.70, 1.49)	
	2-4/wk	309	196	0.74 (0.53, 1.04)		0.92 (0.65, 1.31)	
	≥ 5/wk	178	114	0.75 (0.52, 1.08)	0.037	0.92 (0.62, 1.36)	0.37
Tea	Never	91	73	1.0		1.0	
	< Once/d	138	111	1.00 (0.67, 1.49)		1.10 (0.73, 1.66)	
	Once/d	84	60	0.89 (0.57, 1.40)		1.04 (0.65, 1.67)	
	2-3/d	269	155	0.72 (0.50, 1.04)		0.83 (0.57, 1.22)	
	4-5/d	166	108	0.81 (0.55, 1.20)		0.95 (0.63, 1.44)	
Red wine	6+/d	116	100	1.07 (0.71, 1.62)	0.58	1.21 (0.79, 1.86)	0.94
	< 1 glass/wk	413	343	1.0		1.0	
	1-2 glasses/wk	112	87	0.94 (0.68, 1.28)		1.10 (0.79, 1.53)	
	3-5 glasses/wk	89	52	0.70 (0.49, 1.02)		0.86 (0.58, 1.27)	
	1-2 glasses/d	84	45	0.65 (0.44, 0.95)		0.82 (0.54, 1.24)	
	3-4 glasses/d	80	38	0.57 (0.38, 0.86)		0.85 (0.55, 1.33)	
	≥ 5 glasses/d	86	42	0.59 (0.40, 0.87)	0.0001	0.95 (0.61, 1.48)	0.38

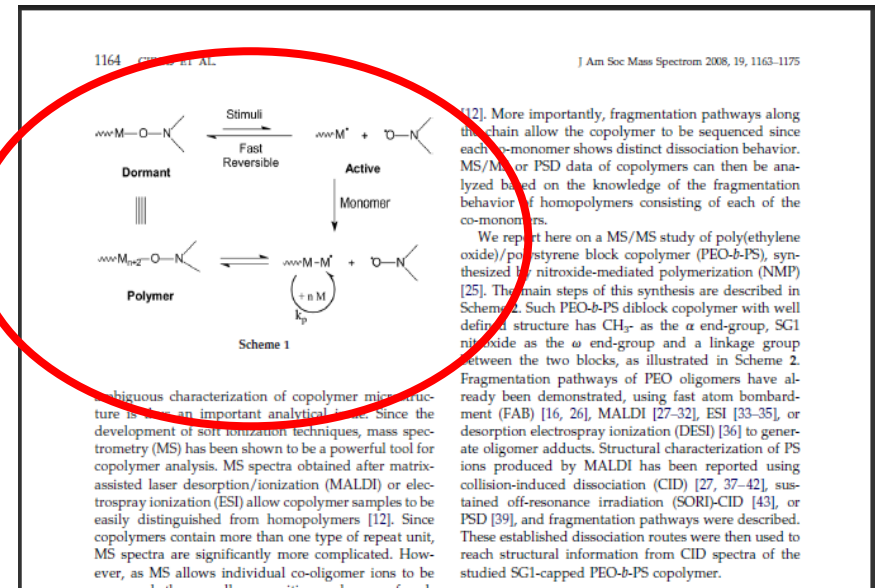
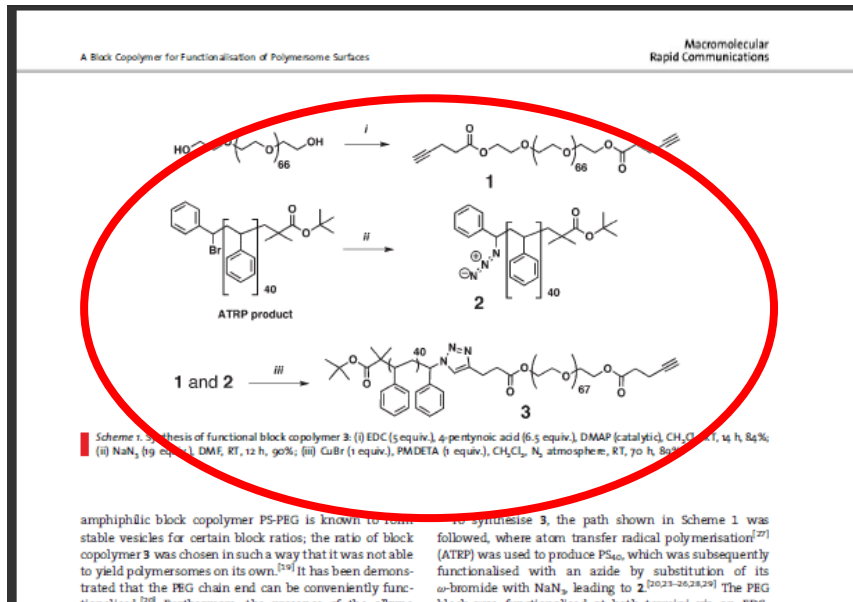
* Controlling for age, sex, body mass index, social class, housing tenure, employment status, whether a single parent, smoking, passive smoke exposure at home, and total energy intake.

nuts, leading to avoidance and a lower intake. This is unlikely to explain the associations between asthma and intake of selenium and apples, which did not change when we excluded individuals who said that they avoided certain foods because of

formation is requested, and comparable rates have been seen in other population-based studies of diet and respiratory health that have used long FFQs (4, 26). Response rates were similar in cases and controls, and intake of selenium and an-

4. 논문의 구성과 작성법 - 본문

Scheme



Scheme 은 반응 체계도를 그림으로 표현한 것임

4. 논문의 구성과 작성법 - 본문

Figures (그림)

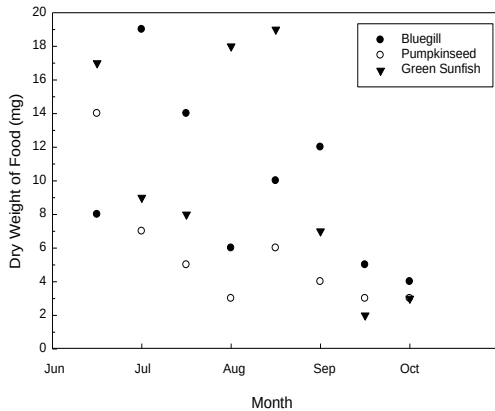


Figure 1. Seasonal changes in dry weight of food eaten by three sunfish species in a pond experiment.

Fig. 1

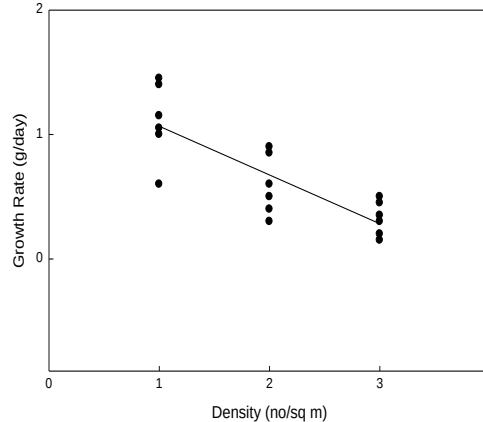


Figure 2. Density-dependent reduction in daily growth for field mice in agricultural fields.

Fig. 2

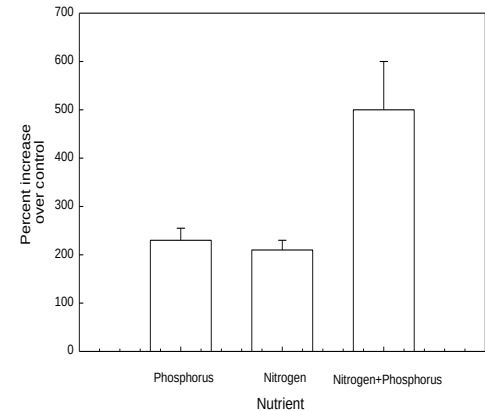


Figure 3. Responses of lake algae to additions of nutrients. Results are for 50 different lakes in North America and error bars are 95 percent confidence limits.

Fig. 3

- **Figures**는 **graphs, maps, photos technical diagrams** 등을 지칭하는 것임.
- **Figures**의 **graph** 종류는 매우 다양하지만 공학 논문에서는 **scatter plots (Fig. 1), line graphs (Fig. 2) and vertical bar graphs (Fig. 3)** 과 같은 **graph**를 많이 사용함.
- **Figures**는 “**camera ready**” “**photo ready**” 형태로서 투고된 상태로 나중에 출판 시에 **축소** 사용될 때 **기호, 숫자, 단위** 등이 명확히 보일 수 있도록 **크기가 충분해야** 하고 **좋은 해상도와 선명도를** 가져야 함

4. 논문의 구성과 작성법 - 본문

Figures

- **Figure** 는 본문에서 거론이 되어야 하며 인용된 **순서대로** 숫자가 매겨져야 함
- 본문에 사용된 **기호와 약호**는 그림에도 **일관되게** 사용되어야 함
- **Figure** 에서는 수평 축과 수직 축이 존재하며 일반적으로 **독립 변수(측정 단위 등)**는 수평 축에 **종속변수(측정한 결과)**는 수직 축에 표시함.
- 수평축과 수직축 모두 간단 명료하게 표시되어야 하며 **label**에는 변수와 측정 단위가 반드시 표시되어야 함.
- 축들은 반드시 평균적으로 증가되게 표시되어야 하며 **tick mark**는 축이나 선 안에 표시되어야 함. 그리고 tick mark는 data의 범위를 포함하여야 하며 data의 난잡함을 피하기 위해 최소한으로 사용하여야 함.
- 같은 조건에서 여러 개의 data 가 얻어진 것은 **평균값**을 취하여 놓고, 표준편차에 의한 **error bar**를 표시함
- **Figure**의 정보를 간단명료히 나타내기 위해 **graph 밑에는 반드시 표제(legend or caption)**가 있어야 하며, 표제는 간단하고 정확한 정보를 가지고 있어야 한다. 표제는 그 자체로서 독립적으로 이해될 수 있도록 작성 되어야 함.

4. 논문의 구성과 작성법 - 본문

Figures 의 예

electro-phosphorescence as a proof of concept demonstrating that WOLEDs with a single emitting center can be achieved. Theoretical calculations rationalize the reasons behind such broad emission, opening the way for generalization of this new strategy for WOLEDs development. Our result demonstrates that low-cost white light-emitting OLEDs with a single emitting center can be achieved.

An usual synthetic route was used to prepare the complex (acetylacetonato)bis(1-methyl-2-phenylimidazole)iridium(III).

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^c Institute of Chemical Sciences and Engineering, Swiss Federal Institute of Technology, Lausanne, CH-1015, Switzerland. E-mail: mukhaja.nazeeruddin@epfl.ch; Fax: +41 216936124; Tel: +41 216934111

† Electronic supplementary information (ESI) available: Experimental details; supplemental figures; computational results. CCDC 730761. For ESI and crystallographic data in CIF or other electronic format see DOI: 10.1039/b908946b

the optical properties of the N966 complex we performed DFT/TDDFT calculations on its ground singlet and on the two lowest triplet excited states, the ones corresponding to the lowest SCF triplet states obtained by population of the LUMO and LUMO+2 (T_1 and T_2 , respectively). For

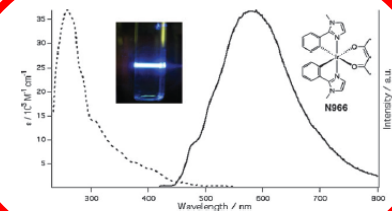


Fig. 1 Absorption (left dotted line) and emission spectra (right full line) of N966 in dichloromethane. The inset shows the chemical structure of N966. The photo shows the white-light emission of N966 obtained upon excitation with a laser light.

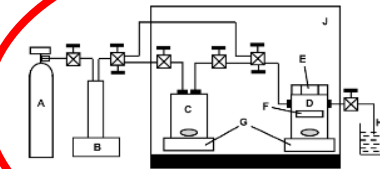


Fig. 1 Schematic representation of the scCO₂ dry etching process. (A): CO₂ cylinder; (B): scCO₂ syringe pump; (C): Mixing chamber; (D): Sample chamber; (E): View cell; (F): Wafer; (G): Electromagnetic stirrer; (H): NaOH solution; (J): Water bath.

2. Experimental

A HF-compatible two-chamber etching apparatus (e.g. pre-chamber and etching chamber) shown in Fig. 1 was used in this study. The pre-chamber was designed for the preparation of etchant solution with pre-mixing of co-solvent and HF/pyridine in CO₂/HF/pyridine complex (70:30 wt/wt; Aldrich) was used as a dry source of HF. HF/pyridine complex was further diluted with anhydrous pyridine. 1M NaOH solution was used to neutralize HF after etching. Carbon dioxide (99.99%, Dae Young Co.) was used as received. A wide variety of co-solvents (e.g., methanol, ethanol, isopropyl alcohol, butanol) were used to observe their effects on etching performance. Blanket wafers with three sacrificial oxides of borophosphosilicate glass (BPSG), p-tetraethylorthosilicate (P-

TEOS) on the dry etching were found to be much lower than those from wet etching.

3.2. Effect of temperature and pressure on etch rate

Temperature is one of the most important parameters that affect etching behavior [27]. A temperature range of 45–75 °C was investigated in this study. Fig. 2 depicts etched thickness of BPSG, P-TEOS, thermal oxide and SiN with HF/pyridine in scCO₂ as a function of temperature at 20.7 MPa. Etch rate was found to increase with an increase in temperature. The etch rate of BPSG is more sensitive to temperature compared to the other films increasing 10 times with an increase in temperature from 45 °C to 75 °C.

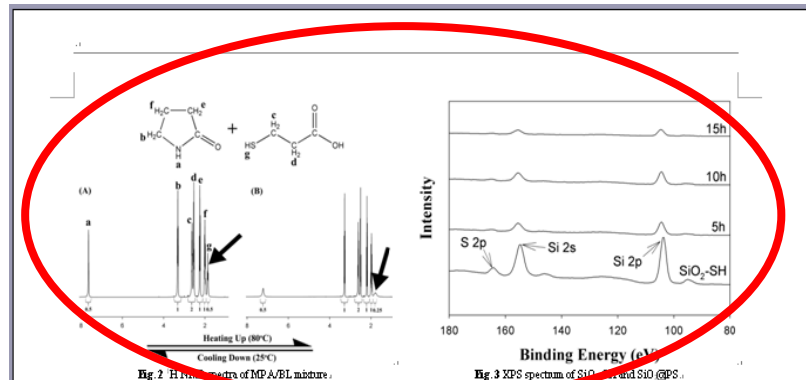
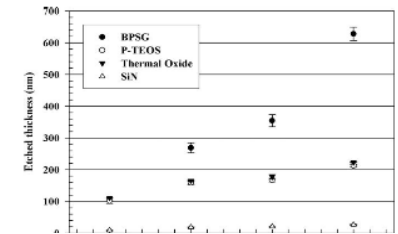


Fig. 2 H NMR spectra of MP/BL mixture.

In order to investigate the intermediate structure of the MP/BL mixture, NMR analysis was conducted with 3-mercaptopropionic acid (MPA), instead of SiO₂-SH. Fig. 2 (A) and (B) represents the H NMR spectra of MP/BL mixture (1:1 molar ratio) at 25 °C and 80 °C, respectively. The proton peak of the S-H (1.75 ppm) is clearly seen in Fig. 2(A), but it becomes weak and broad in the MP/BL mixture at 80 °C (see Fig. 2(B)). The integration ratio of the peak decreases from 0.5 to 0.25, proving that ca. 50% of

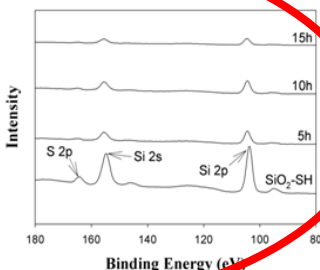


Fig. 3 XPS spectrum of SiO₂-coated SiO₂@PS.

The product was well dispersed in solvents which are good for PS. From the XPS analysis of the SiO₂@PS (Fig. 3), it is found that the Si_{2s} and Si_{2p} peak in SiO₂-SH particles decreases as polymerization time increased, indicating that the surface is covered by PS layer. The conversion of the monomer was above 50% after the polymerization for 15 h. In order to determine the molecular weight of the grafted PS, the particles were dissolved in toluene and SiO₂ cores were etched by 5%

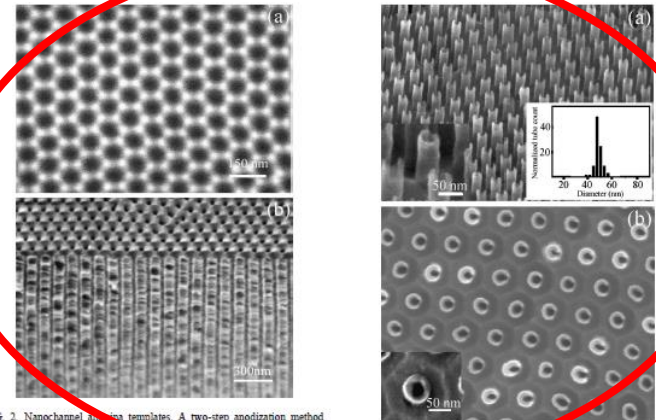


FIG. 2. Nanochannel alumina templates. A two-step anodization method (see Ref. 19) was used to obtain the hexagonal close-packed nanochannel alumina templates: (a) SEM image showing top view of the hexagonal close-packed nanochannel alumina template after first anodization showing top view of the result; (b) Second anodization. The patterned surface from the previous step is anodized again.

FIG. 3. Highly-ordered carbon nanowire arrays. (a) SEM image showing oblique view of the nanowire array. The inset at the lower left is a histogram of the nanowire diameter distribution.

4. 논문의 구성과 작성법 - 본문

감사의 글 (*Acknowledgements*)

Acknowledgements

settled 20% in 30 min
he top. This clearing of
emulsion consisted of
1 CO₂ continuous phase,

This work was supported by grant (20015-308-01-2), and
grant (R01-2000-00323) from the Basic Research Program,
of the Korea Science and Engineering Foundation. This
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5. 논문 온라인 업로드 및 심사프로세서

- 우선, 해당논문에 적합한 저널을 선택하는 것이 중요 (분야 및 수준)
- **step-by-step guide** for publishing in a journal



5. 논문 온라인 업로드 -저널선택

웹 홈페이지에서 **Aims and scope** 를 보고 투고할 논문에 적합한 저널인지 확인함

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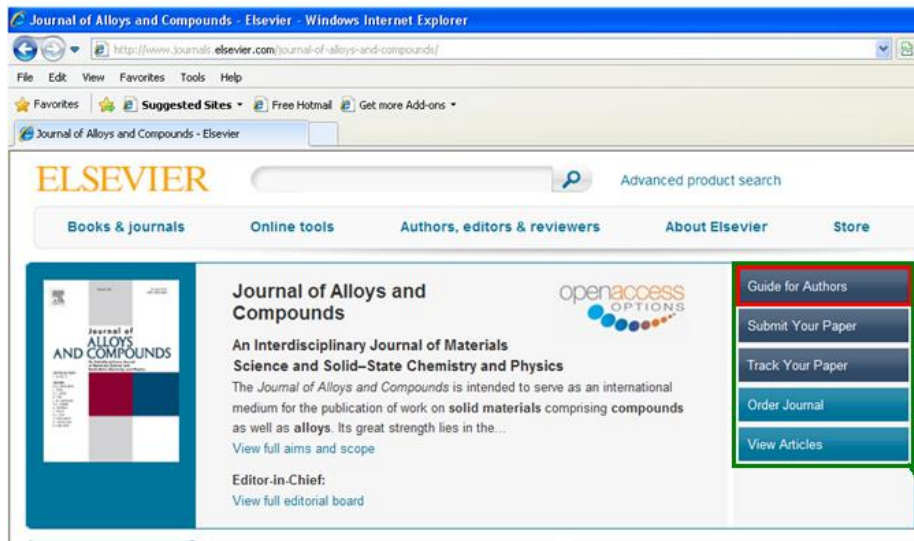
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Aims and scope

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Guide for Authors 를 읽고 논문체계 (참고문헌 서식 등)와
필요한 자료(**cover letter, graphical abstract** 등)를 준비함



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표지 (Cover letter)

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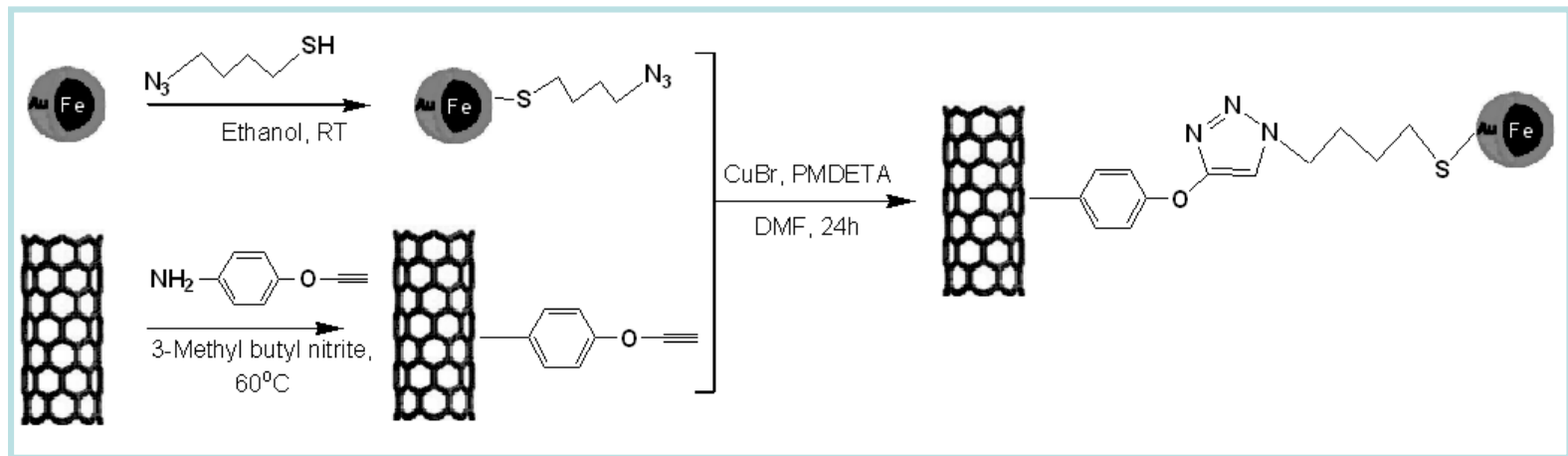
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Research highlights

- ▶ The Fe@Au NPs anchored MWNTs was synthesized *via* click chemistry.
- ▶ The Fe@Au/MWNTs nanohybrids were investigated by FT-IR, XPS, EDS, XRD, and TEM.
- ▶ Elemental analyses by XPS and EDS suggested the preparation of Fe@Au/MWNTs.
- ▶ The SQUID study revealed that the nanohybrids possess superparamagnetic character .

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A facile route for the preparation of a new nanohybrid comprising of multi-walled carbon nanotubes (MWNTs) and Au-coated Fe nanoparticles (Fe@Au NPs) has been realized. The Fe@Au NPs anchored MWNTs (Fe@Au/MWNTs) nanohybrids were synthesized by the reaction of azide-containing Fe@Au NPs with alkyne-functionalized MWCNTs via the Cu(I)-catalyzed 1,3-dipolar cycloaddition reaction. The as-prepared Fe@Au/MWNTs nanohybrids were investigated by FT-IR, XPS, EDS, XRD, and TEM analyses. The covalent ligation between the segments in nanohybrids was confirmed by FT-IR studies. The elemental mapping analyses by XPS and EDS suggested the successful preparation of Fe@Au/MWNTs nanohybrids. The SQUID study revealed that the nanohybrids possess ferromagnetic character which is susceptible to

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Institution*	Anhui University, Hefei 230039, PR China
E-mail Address*	xiansongliu@ahu.edu.cn
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Action	Title	Date Submission Began	Status Date	Current Status	Ethics in Publishing
Action Links	Covalent ligation of gold coated iron nanoparticles to the multi-walled carbon nanotubes employing click chemistry	Sep 06, 2012	Sep 06, 2012	Needs Approval	☐ I accept

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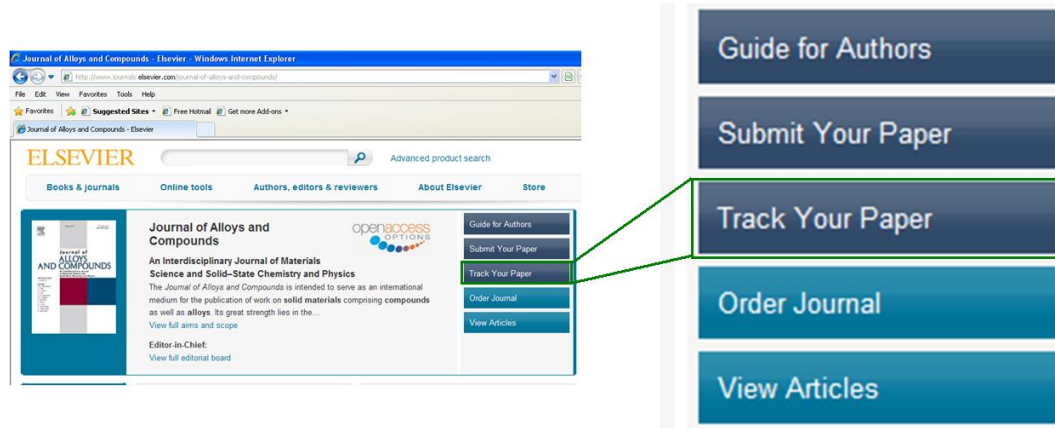
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Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status	Date Final Disposition Set	Final Disposition
Action Links	JALCOM-D-12-04249	Covalent ligation of gold coated iron nanoparticles to the multi-walled carbon nanotubes employing click chemistry	Sep 06, 2012	Jan 28, 2013	Completed - Accept	Jan 28, 2013	Accept

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5. 논문 심사프로세서



2. 1차 심사 – 보통 2~3인의 동료과학자에 의해 심사 및 결과 통보

→ accept, **minor (major)revision**, 또는 reject

3. **수정 투고 (revised manuscript + response to reviewer's comments)**

4. 2차 심사 – **minor revision** 또는 accept

5. 게재승인 통보

6. 교정쇄 확인

7. 출판

6. **R&D** 연구방법과 논문작성 노하우

논문심사에서 게재불가의 사유들

1. 주된 내용이 새로운 것이 아니거나 중요성이 없는 경우
2. 잘못된 결과를 제시하거나 이미 알려진 결과 또는 해석을 한 경우
3. 언어가 잘 구사되지 않은 경우 (문법, 어휘, 단어 등).
4. 연구가 체계적으로 잘 수행되지 않은 경우
5. 투고원고의 기술이 잘못되었으며 학술지의 규정에 따르지 못한 경우.
6. 결과들이 결론에 도달하지 못한 경우: 불충분한 자료
7. 결과에 대한 해석(설명)이 생략되거나 토의가 미비한 경우.
8. 적절한 참고문헌과 관련된 연구들을 망라하지 못한 경우
9. 초록, 그림과 표가 적절하게 작성되지 않은 경우
10. 학술지의 성격 (특성)에 맞지 않은 내용인 경우.
11. 일차 논문수정요구에 성의껏 답변 및 수정보완이 되지 않은 경우 등이 있음.

R&D 연구방법과 논문작성 노하우

논문 작성 실전에 대한 조언

1. SCOPUS, SCI finder 등 검색엔진을 이용하거나 google scholar 등 인터넷 검색을 사용하여 **적합한 참고 논문을** 찾는다. (일반적으로 한국학생들의 실험능력은 우수하지만 **reference** 활용은 매우 취약함)
2. 실험계획수립과 수행은 논문작성을 **염두에** 두고 진행한다.
3. 실험이 **완료되기 전에 논문 작성을 시작해본다.** (작성과정에서 자주 기존 계획과의 차이가 드러나며 실험의 개선 필요성이 나타나는 경우가 많음)
4. 서론부터 차례대로 적어 나가는 것은 전체적으로 통찰력을 가져야 하는 부분이 있으므로 막상 시작하고 진행하기가 쉽지 않다. 따라서, **실험방법부터 먼저 기술하며 시작부터 한다.** (기존의 방법들이 비슷하게 사용되기 때문에, 문장의 선택 등 작성이 용이하여 본격적인 논문작업에 들어가기에 용이하다)
5. 결론을 **대충** 적어보고, **결과 및 토론부분의 나열 및 토론 순서를** 정해본다

R&D 연구방법과 논문작성 노하우

논문 작성 실전에 대한 조언

6. 결과들을 나열하고, 표 및 그림을 작성한다. 기존의 참고문헌과 필요 시 보완실험 결과 등을 동원하여 결과의 유사점과 새로운 점을 분석하고 토의한다. 유사점은 기존 논문을 인용하며, 새로운 결과는 기존논문 인용 및 데이터 분석을 토대로 그 이유를 제시한다
7. 결론 부분을 결과 및 토론의 순서대로 정리하여 완성한다.
8. 서론 부분을 참고 문헌 인용과 함께 완성한다.
9. 작성된 논문의 취지에 가장 알맞게 초록과 제목을 작성한다.
10. 참고문헌 리스트를 작성한다.
11. 특정부분의 영어작문에 자신이 없을 경우, 우선 요점을 한글 문장으로 적고, 비슷한 내용의 단어, 구, 절 등을 참고문헌에서 찾아 자신의 문맥으로 수정 편집해본다
12. 작성된 논문의 영어맞춤법에 자신이 없으면 사설 교정업체에 교정을 의뢰하여 수정한다

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언어

1. 정확한 단어를 구사함 - 무리하게 번역도구를 이용하지 않고, **아는 단어에서** 선택하고, 확신이 서지 않으면 그 단어의 **예문들**을 보고 문맥을 파악함
“The application of a graphene film...” → “**The use of a graphene film...**”
2. 긴 형용사 구는 지양함 (문장이 길어지더라도 **분명한 표현**을 사용해야 함)
 - ; High-Performance carbon nanotube-implanted mesoporous carbon spheres for supercapacitors with low series resistance
→ **The use of microporous carbon spheres doped with carbon nanotubes for the manufacture of high-performance supercapacitors with low series resistance**
 - ; “a gelatin dispersed multiwalled carbon nanotube composite film” → **“a gelatin-dispersed multiwalled carbon nanotube composite film” or “a composite film of multiwall carbon nanotubes dispersed in gelatin”**
 - ; “Soft-template synthesized ordered mesoporous carbon counter electrodes”
→ **“Ordered mesoporous carbon counter electrodes synthesized using a soft template”**

R&D 연구방법과 논문작성 노하우

언어

3. 문맥에 적절한 **분사법** 사용 (“-ing”와 “-ed”)
 - ; “boron containing carbon” vs “boron-containing carbon” (= carbon that contains boron)
 - ; some boron-contained carbon → some carbon contained in a boron capsule
 - ; “The material is oxidizing.” vs “the material is oxidized.” vs “The material is oxidizing the substrate.”
4. *via*, *in-situ* 등 **라틴어**를 부정확하게 사용하지 않아야 함
 - ; “the carbon was produced *via* chemical vapor deposition”(X) → “the carbon was produced by chemical vapor deposition”
 - ; “proceed from an alcohol to an acid *via* an aldehyde.(O)”
 - “determine the structure *via* n.m.r.” (X)
5. Respectively의 바른 사용
 - “Samples were heated at 250, 400 and 600 °C, **respectively**”. (X)
 - “Samples A, B and C were heat-treated at 250, 400 and 600 °C, **respectively**”(O)

R&D 연구방법과 논문작성 노하우

언어

5. 형용사법의 잘못된 표현

“the synthetic conditions” (X) → “the synthesis conditions”

“carbon fibers properties” (X) → “carbon fiber properties” or “properties of carbon fibers”

6. 중복된 구 ; “schematic illustration” (X)

집합명사 ; “Previous works (researches) on …” (X) → “Previous work (research) on…” or “Previous studies (papers) on…”

“Recently, there has been much research…”. (O)

“The equipments used…” (X) → “The equipment used…”

7. 가급적 사용을 자제해야 할 단어들

“New”, “Novel”, “For the first time”,

“Facile” → easy or simple

맞음말

논문 작성자의 자세

논문의 특성이 일관성, 체계성, 과학적 분석성과 함께 신속성을 가지고 있으나, 논문의 작성에는 많은 노력과 시간이 소요되기 때문에 좋은 논문을 생산하기 위해서는 작성자는 높은 수준의 **집중력**과 **끈기**를 가져야 함.

참고문헌

1. P. A. Thrower, Carbon, 45 (2007), 2143-2144
2. P. A. Thrower, Carbon, 46 (2008) 183-184
3. P. A. Thrower, Carbon, 46 (2008), 1113-1114
4. P. A. Thrower, Carbon, 48 (2010), 2675-2676
5. P. A. Thrower, Carbon, 49 (2011), 4957-4960