科技英语实践

课程成绩

50%课堂表现+50%课后作业

Tuning mechanical properties of graphene-derived materials through topological defects and interlayer crosslinks

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Abstract: Recently, graphene-derived materials, e.g. graphene oxide paper, graphene mem brane and graphene foam, have attracted great research interest. Owing to their ex cellent mechanical, electrical properties, lightweight and sub-nanometer channe these type of materials hold great potential applications in aerospace, flexible elec trodes and sensors, desalination, gas separation, etc. For the aforementioned gra phene-derived materials, the graphene sheets are assembled in a layer-by-laye manner. Due to the discontinuity of graphene sheet, the in-plane tensile load in on graphene sheet is transferred to another graphene sheet through interlayer shearing based on which a deformable tension-shear model (DTS) has been proposed in pre vious literatures [1, 2]. The in-plane mechanical properties of graphene sheet, inter layer shear properties and graphene sheet size are the dominated factors to deter mine the mechanical properties of graphene-derived materials. In order to improv the interlayer load capacity of graphene sheet, several approaches are proposed such as inducing topological defects in graphene sheet to generate wrinkled config uration, interlayer crosslink and graphene-carbon nanotube network [3, 4]. The in plane tensile and interlayer shear properties of graphene sheet with different type of topological defect and interlayer crosslink are systematically studied. Althoug the interlayer shear properties are significantly improved by these methods, the in plane mechanical properties are usually weakened due to the defects or functiona groups in graphene sheet. The optimum design of the mechanical properties fo graphene-derived materials should be the balance of in-plane tension and interlaye shear load transfer. Based on this idea, the optimum concentration of interlaye crosslink and graphene sheet size are deduced.

Keywords: graphene-derived materials; topological defect; interlayer crosslink; mechanica properties; tension-shear chain model

1. Introduction

Graphene-derived materials (papers, fibers, films etc.) usually feature layer-by-layer micro structures with single sheet spanning over hundreds of micrometers. In comparison with par ticle or fiber-based reinforced composites, they demonstrate many advantages, such as th extreme exposure of graphene sheets to the environment for functionalization, enabling ric and tunable crosslinking mechanisms between them. Recently, a number of theoretical an experimental efforts have been made in predicting and optimizing mechanical performance c this class of materials. Similar structural hierarchy broadly appears in biological materials such as bones, teeth and nacre, where brittle minerals and soft proteins are integrated for thei superior strength and toughness. However, due to different synthesis technologies, numerou types of crosslinks and complex hierarchical structures, there still lacks a comprehensiv

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studies to explore the mechanical behaviors of graphene-derived materials, which limits the optimization design of this class of materials.

2. Results

Molecular dynamics simulations are carried out to study the shear properties of interlayer crosslinks, i.e. graphene oxide (GO) bilayers crosslinked by covalent bonds with glutaralde-hyde (GA), hydrogen bond networks through water molecules, as well as their combination, as shown in Figure 1a. The results show that for GA crosslinks, the shear stress first increases to 490 MPa, followed by an abrupt decrease to a lower level of 140 MPa. For GO with water intercalation, hydrogen bond networks are formed between the functional groups at graphene sheets and water molecules and have shear strength τ_s = 400 MPa. With these benefits from GA and water intercalations, the bimodally crosslinked GO sheets demonstrate combined high shear strength from GA and after-failure performance from the reversibility of H-bond network between water and oxygen containing groups in GO, as shown in Figure 1b.

By considering the in-plane deformation of graphene sheet and interlayer shear deformation, a deformable tension-shear chain (DTS) model is proposed to describe the mechanical behav-iors of graphene-derived materials, as illustrated in Figure 2a. The shear strength and inter-layer space for different types of interlayer crosslink are given in Figure 2b. Based on DTS model, the optimum concentrations of the functional groups in graphene sheet to maximize the stiffness and strength of graphene-derived materials are deduced. The detailed analysis can be found in our previous works [1, 2].

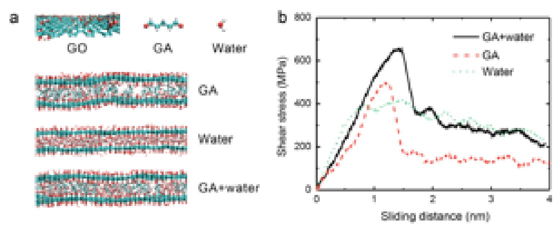

Figure 1. (a) Illustrations of the interlayer crosslink of GO bilayers and (b) their shear behaviors [1].

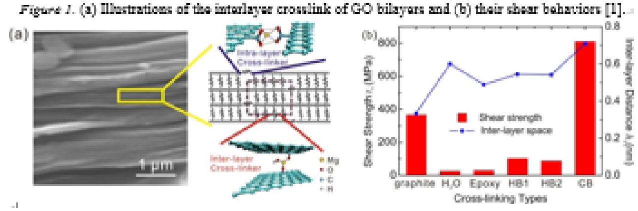

Figure 2. (a) The DTS model of graphene-derived materials. (b) The shear strength and interlayer space for different types of interlayer crosslink [2].

3. Conclusions

The interlayer shear properties for different types of interlayer crosslinks, such as covalent bonds, hydrogen bond networks and coordinate bonds are studied. The interlayer crosslink of covalent bonds has higher shear strength, but it loses load capacity after failure. While, the interlayer crosslink of hydrogen bond networks has good load capacity after the peak shear stress due to the reconstruction of hydrogen bonds. By considering the in-plane tensile de-formation and interlayer shear deformation, a DTS model is proposed which can describe the mechanical behaviors of graphene-derived materials well.

Acknowledgements

The authors would like to acknowledge the financial support from National Natural Science Foundation of China (No. 11572239).

References

[1] Yihun Liu and Zhiping Xu. Multimodal and Self-healable Interfaces Enable Strong and Tough Gra-phene-derived Materials, *Journal of the Mechanics and Physics of Solids* 2014:70: 30–41.
[2] Yihun Liu, Bo Xie, Zhong Zhang, Quanshui Zheng and Zhiping Xu. Mechanical Properties of Gra-phene Papers, *Journal of the Mechanics and Physics of Solids* 2012:60: 591-605.

SCI科技论文写作

- **SCI, EI论文写作**

The Science Citation Index (SCI) is a citation index originally produced by the Institute for Scientific Information (ISI) and created by Eugene Garfield. It was officially launched in 1964. It is now owned by Thomson Reuters. The larger version (Science Citation Index Expanded) covers more than 6,500 notable and significant journals, across 150 disciplines, from 1900 to the present.

The Engineering Index (EI) is an engineering bibliographic database published by Elsevier. It indexes scientific literature pertaining to engineering materials, including 3,615 journals. Beginning in 1884, it was compiled by hand under the original title of Engineering Index. Elsevier purchased the parent company Engineering Information in 1998.

SCI论文基本知识

1. SCI期刊定义
2. SCI期刊影响因子
3. SCI论文被引用次数(他引，H因子)
4. SCI论文类型

The impact factor (IF) of an academic journal is a measure reflecting the average number of citations to recent articles published in that journal. It is frequently used as a proxy for the relative importance of a journal within its field, with journals with higher impact factors deemed to be more important than those with lower ones.

ADVANCED MATERIALS

Whitesides' Group: Writing a Paper**

By *George M. Whitesides**

- 美国三院院士
- 哈佛大学教授
- 引用最高的化学家

Weitzlab Guide to Good Paper Writing

David A. Weitz

- 美国三院院士
- 哈佛大学教授

Whitesides 研究组：撰写科技论文要点

（G.M. Whitesides 原作[1]、吕存景翻译、郑泉水校注[2]）

译注 1：该文作者是哈佛大学化学与化学生物系教授，曾担任化学领域最有影响的两杂志之一 JACS 主编。这是给他研究组成员如何准备和撰写论文的提要。这样一篇短文，居然发表在材料领域顶级杂志 Adv. Mat. 上，并据说成为 Whitesides 被引用最高的论文之一。我阅读后深受启发，认为应该成为我们研究组成员必须精读、细细体会、不断实践的纲领。不能高效率地撰写论文，是长期困扰我们研究组的一个大问题。Whitesides 的这篇论文，不仅教我们如何**最有效率**地撰写科技论文，更是教如何高效率的进行研究和具有相当普遍意义的表达技巧。

2.2. How Should You Construct an Outline?

The classical approach is to start with a blank piece of paper, and write down, in any order, all important ideas that occur to you concerning the paper. Ask yourself the obvious questions: “Why did I do this work?”; “What does it mean?”; “What hypotheses did I mean to test?”; “What ones did I actually test?”; “What were the results? Did the work yield a new method of compound? What?”; “What measurements did I make?”; “What compounds? How were they characterized?”. Sketch possible equations, figures, and schemes. It is essential to try to get the major ideas. If you start the research to test one hypothesis, and decide, when you see what you have, that the data really seem to test some other hypothesis better, don’t worry. Write them both down, and pick the best combinations of hypotheses, objectives, and data. Often the objectives of a paper when it is finished are different from those used to justify starting the work. Much of good science is opportunistic and revisionist.

When you have written down what you can, start with another piece of paper and try to organize the jumble of the first one. Sort all of your ideas into three major heaps (1–3).

Weitzlab Guide to Good Paper Writing

Last updated 5/17/02

These are suggestions for writing better scientific papers. However, please remember that, like all cases with the English language, these are not rules, but are guidelines, and there will certainly be times that they do not apply or that they should be changed. Nevertheless, do this only with care and foreknowledge.

Conclusion:

- Start with the conclusion first. Make it one sentence, two at most. Have a single, key point you are trying to make. If you write this first, then you can write the rest of the paper to just make this point.

Main point of the paper:

- *A short paper* (Science, Nature, PRL or other letters journal) can only make one main point, and perhaps half of a second point.
- *A longer paper* can make an additional point. However, rarely can a single paper make more than a couple of points. There should always be a central point for each paper.

论文的形式

- 同行评议的研究论文
  - 全文(article, full paper…)
  - 通讯(communication, letter…)
  - 简报(note, letter…)
- 正式发表的学术会议论文
  - Proceedings, special journal issue
  - 不同学科的认同度不同
- 综述(Review)或评论

几点说明：

- 发表论文不等于学位论文；
  学位论文讲究系统性、工作量、深度
- 做实验前，想想结果能不能发，往哪里发？
- 一点之见即可成文，不能贪多
- 发表论文不等于科研；论文为科研的一部分
- 不能为了发论文而发论文；
- 用心去写；

论文基本内容

- Title,
- Authors,
- Affiliations (Postal address, email, tel., fax)
- Abstract,
- Keywords,
- Main text

（introduction， method， result， discussion， conclusion）
- Acknowledgements,
- Appendix (if any),
- References,
- Tables,
- Figure captions,
- Separate figures

Title page

核心之一

核心之二

- 标题
- 署名
- 单位地址

Title

- 论文如自己的孩子，人如其名，象给自己的孩子起名字一样给Paper起Title
- 简洁、清晰
- 醒目、生动
- 吸引读者
- 体现特色
- 不雷同
- 按照期刊要求
- 永远不要出现novel, new等字眼

*一般不用“**Effect of…**”，“ **Studies on…**”*

Ductile "Ice": Frozen hydrogels with high ductility and compressive yielding strength

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Ductile ice
Frozen hydrogel
High yielding strength
Repeatable
Large deformation

ABSTRACT

Ice, the solid state of water, which mainly consists of a hexagonal crystal structure in bulk, is usually very brittle. Although ice appears less brittle under compression or shear at a relatively low strain rate, it is by no means a ductile material as metal and is seldom considered as an engineering material in applications other than igloos. We report herein the astonishing ductility and high compressive yielding strength of a polymeric hydrogel in a frozen state. Containing 88 wt. % of water, the hydrogel appears like ice when frozen, and embraces most other physical properties of ice. Meanwhile, the frozen hydrogel not only shows a high compressive modulus (~1 GPa at -25 °C) and yielding strength (~20 MPa at -25 °C), but is also ductile enough to sustain extremely large deformation such as bending, twisting, stretching, extensive shaping, and even machining in a large low temperature range. The ductility at a high strain rate also makes it a material with a significant impact resistivity. Moreover, the frozen gel also exhibits the repeatable ductility - the large plastic deformation is completely recoverable at an elevated temperature. These results will be important towards developing low-cost and environment-friendly engineering materials used in a low temperature range when ductility and reusability is required.

Abstract

应该用简洁、明确的语言将论文的“目的(Purposes)”，主要的研究“过程(Procedures)”及所采用的“方法(Methods)”，由此得到的主要“结果(Results)”和得出的重要“结论(Conclusions)”表达清楚。

- 要写好英文摘要，**必须回答好以下问题**：
- **1)** 本文的目的或要解决的问题**(What I want to do?)**
- **2)** 解决问题的方法及过程**(How I did it?)**
- **3)** 主要结果及结论**(What results did I get and what conclusions can I draw?)**
- **4)** 本文的创新、独到之处**(What is new and original in this paper?)**

- **一般原则：**
- **1) 尽量用短句(use short sentences)。**
- **2) 描述作者的工作一般用过去时态(因为工作是在过去做的)，但在陈述由这些工作所得出的结论时，应该用现在时态。**
- **3) 一般都应使用动词的主动语态，**

  如：写成A exceeds B比写成B is exceeded by A更好。

Ice, the solid state of water, which mainly consists of a hexagonal crystal structure in bulk, is usually very brittle. Although ice appears less brittle under compression or shear at a relatively low strain rate, it is by no means a ductile material as metal and is seldom considered as an engineering material in applications other than igloos. We report herein the astonishing ductility and high compressive yielding strength of a polymeric hydrogel in a frozen state. Containing 88 wt. % of water, the hydrogel appears like ice when frozen, and embraces most other physical properties of ice. Meanwhile, the frozen hydrogel not only shows a high compressive modulus (~1 GPa at -25 °C) and yielding strength (~20 MPa at -25 °C), but is also ductile enough to sustain extremely large deformation such as bending, twisting, stretching, extensive shaping, and even machining in a large low temperature range. The ductility at a high strain rate also makes it a material with a significant impact resistivity. Moreover, the frozen gel also exhibits the repeatable ductility - the large plastic deformation is completely recoverable at an elevated temperature. These results will be important towards developing low-cost and environment-friendly engineering materials used in a low temperature range when ductility and reusability is required.

- ◆ 关键词

来源于论文标题

来源于论文摘要

来源于论文结论

…………………

3.3 Introduction（前言是关键）

- 前言要解决什么问题？（三段论）
  - 为什么要做这个工作?
  - 前人已经做了什么?
  - 我们在此采用什么技术做了哪些事情？这些事情相对于前人而言有什么进步或突破？为什么我们能进步或突破?
- 前言是说服他人认可我做这个工作是有意义的
  - 首先要说服自己

- Introduction直接决定审稿人是否有兴趣把你的论文读下去
- Introduction切忌泛泛而谈，言之有据！审稿人是专家，不需要科普；
- 分析其他学者研究工作，指出成绩与进展（他们很可能是你论文的审稿人，每个人都喜欢正面的评价），同时委婉地指出他们的工作可能在哪些方面存在不足（切忌攻击性语言）；
- 指出的他们工作中的不足，必须是你的论文得以解决的！否则，搬起石头砸自己的脚
- 介绍清楚研究的目的；
- 清晰的说明研究工作的创新性

Figures

- 论文的基础——材料学科的论文，是建立在摆事实（Results，由Figures & Tables来体现）、讲道理（Discussion）的基础上。
- 只给出对全文有用的图片——图片可以慢慢用，挑选对论文主题有用的图片使用。不要希望一篇论文用掉所有数据；否则既累赘，又不经济！
- 把全文的图片都整理好之后，再写论文——论文主体就是叙述图片、分析图片。

——熟练使用Origin等绘图软件！

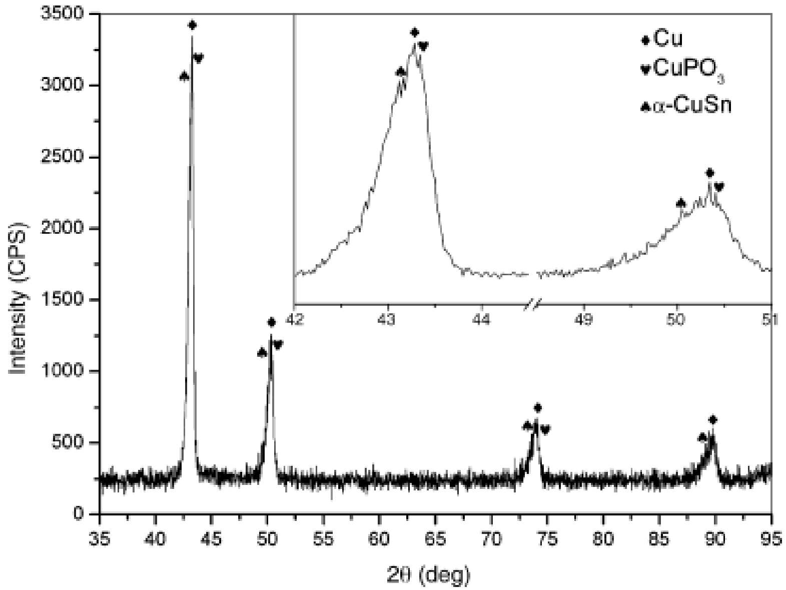


Fig. 3. XRD spectrum of the laser sintered sample.

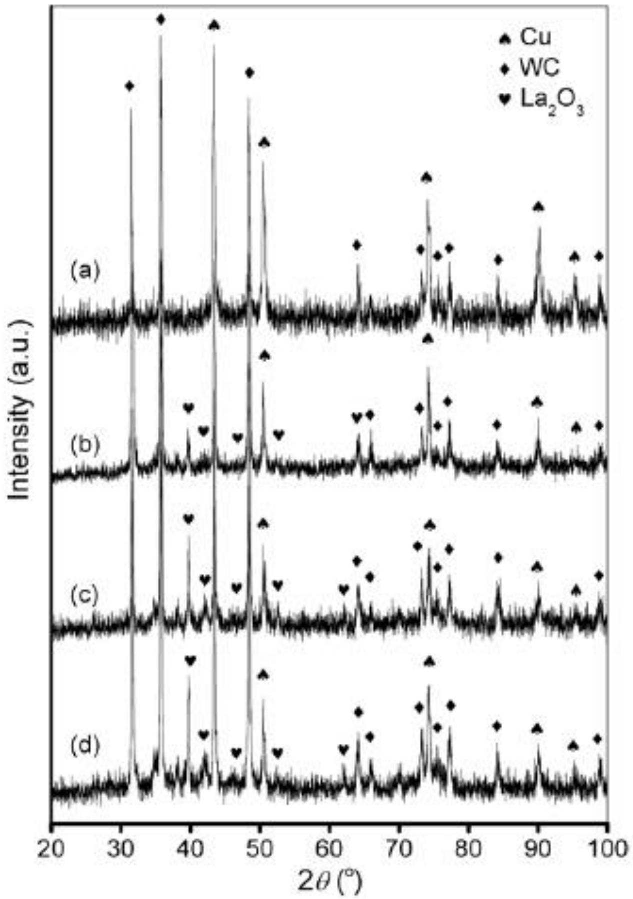


Figure 2. XRD spectra of laser sintered samples using (a) powder A, (b) powder B, (c) powder C and (d) powder D with variation of La_2O_3 contents.

——合理的机理探讨，离不开示意图！一张图片胜过几段文字。**Word能打字，更能画图。**

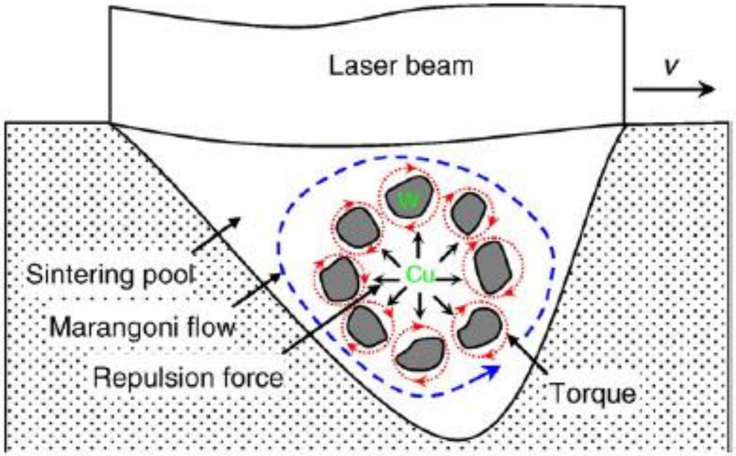


Fig. 3. Schematic describing the formation mechanism of W-rim/Cu-core structure.

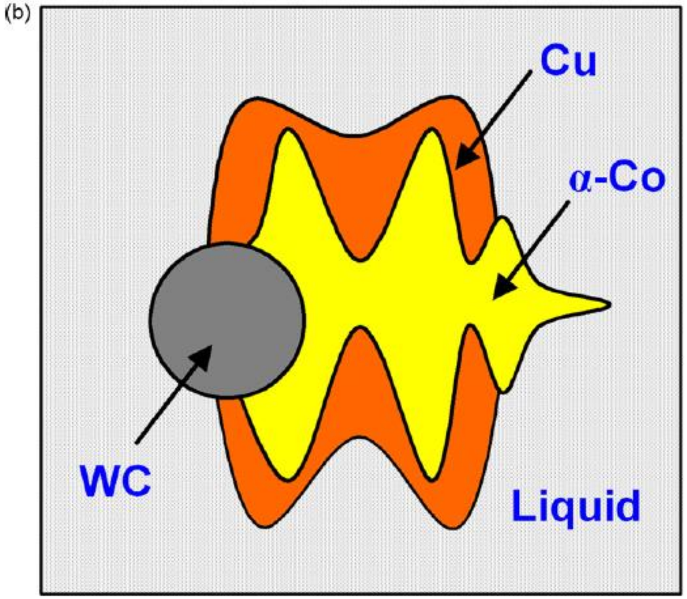
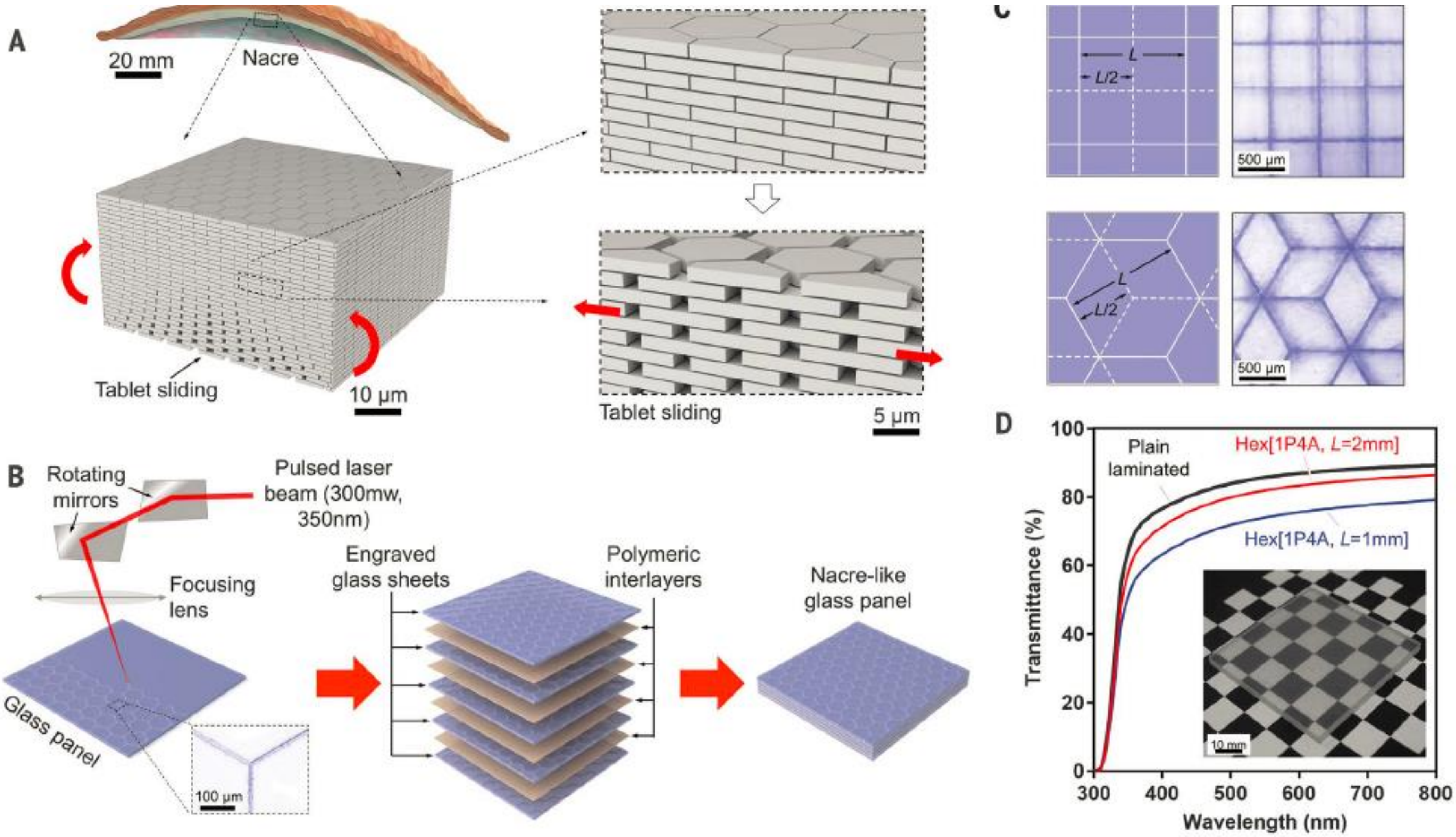


Fig. 9. Binary phase diagram of Co/Cu system (a) [22]; schematic of phase development during Co/Cu peritectic reaction (b).


A
20 mm
Nacre
Tablet sliding
10 μm
Tablet sliding
5 μm
C
L
L/2
500 μm
L
L/2
500 μm
B
Rotating mirrors
Pulsed laser beam (300mw, 350nm)
Focusing lens
Glass panel
100 μm
Engraved glass sheets
Polymeric interlayers
Nacre-like glass panel
D
Plain laminated
Hex[1P4A, L=2mm]
Hex[1P4A, L=1mm]
Transmittance (%)
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400
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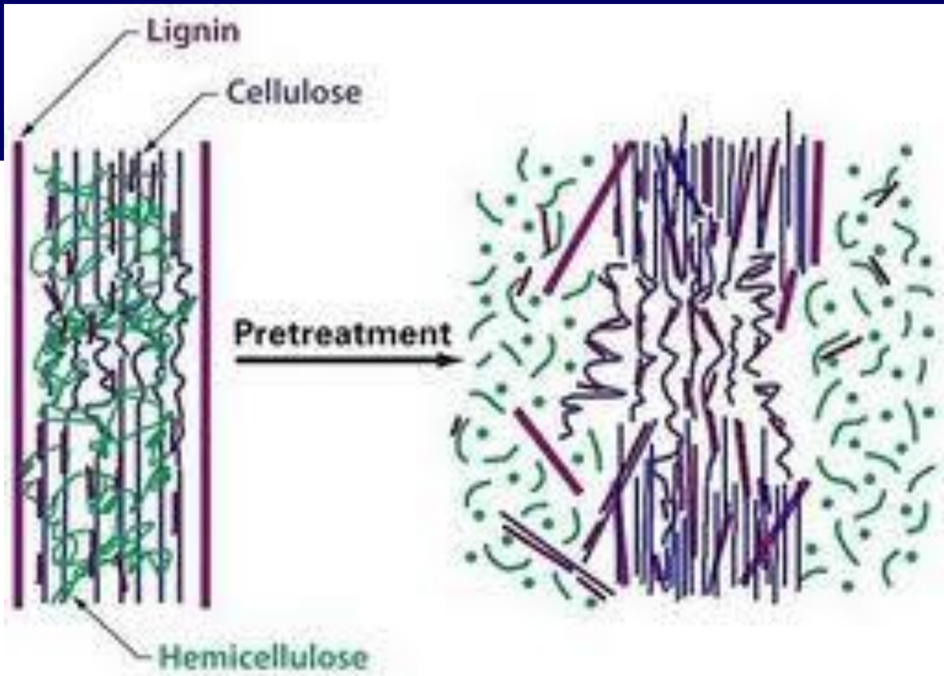
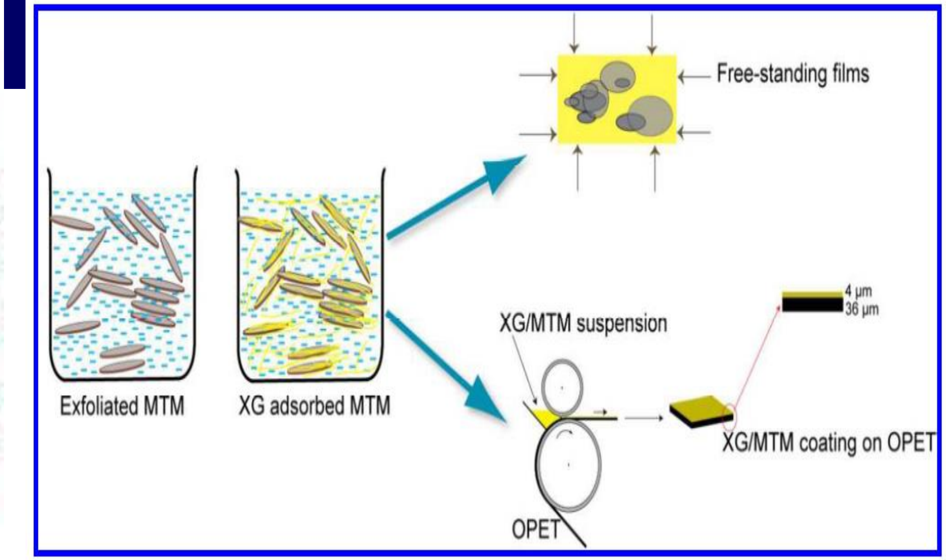
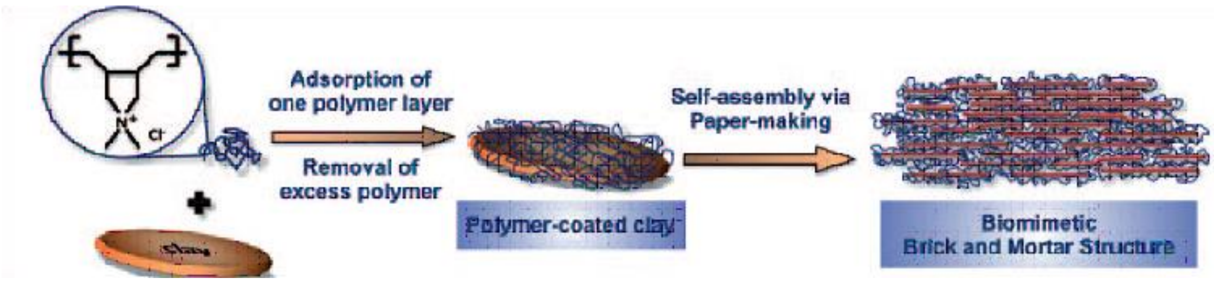
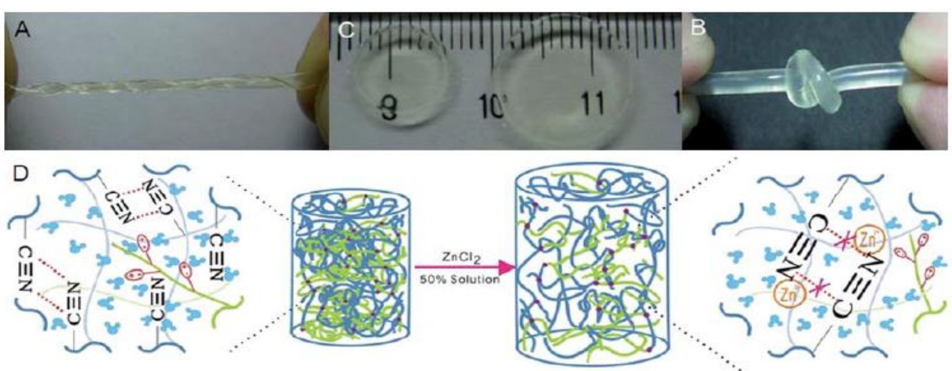
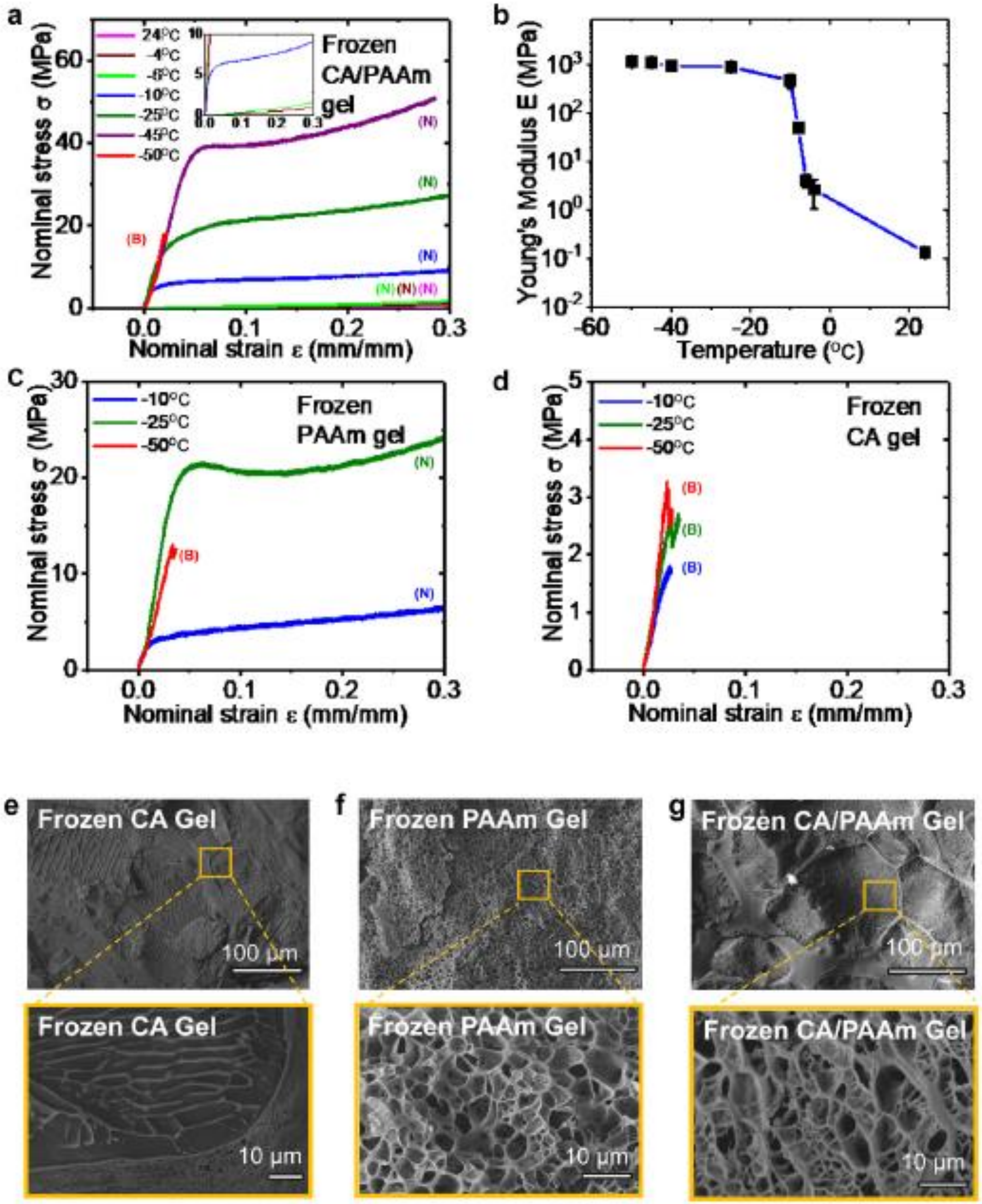
600
700
800
10 mm


Lignin
Cellulose
Pretreatment
Hemicellulose


Free-standing films
Exfoliated MTM
XG adsorbed MTM
XG/MTM suspension
4 µm
36 µm
XG/MTM coating on OPET
OPET


Adsorption of
one polymer layer
Removal of
excess polymer
Polymer-coated clay
Self-assembly via
Paper-making
Biomimetic
Brick and Mortar Structure


A
C
B
D
ZnCl2
50% Solution



a
Frozen CA/PAAm gel
24°C
-4°C
-8°C
-10°C
-25°C
-45°C
-50°C
Nominal stress σ (MPa)
Nominal strain ε (mm/mm)
b
Young's Modulus E (MPa)
Temperature (°C)
c
Frozen PAAm gel
d
Frozen CA gel
e
Frozen CA Gel
100 μm
10 μm
f
Frozen PAAm Gel
g
Frozen CA/PAAm Gel

常用的软件：

- ✓ **Photoshop；**
- ✓ **ChemDraw （ChemBioDraw）；**
- ✓ **Illustrator, Fireworks, SmartDraw, Word等等；**
- ✓ **画示意图**
- ✓ **画数据图（Origin）**

◆Main text（method，result，discussion，conclusion）——论文中第二难写的部分

Materials and methods

- 实事求是地描叙自己的实验材料，实验设计、实验过程、测定方法，数据的采集，分析、计算及其统计方法等
- 使人能够重复
- 可以套用模板
- 不要一字不漏地描写你的材料与实验过程，注意篇幅

Results & Discussion (重点)

- 摆事实：**Results**，描述结果、说明问题、解释原因，各种表征相互印证
- 讲道理：**Discussion**，与文献(30%)做对比，纵向和横向比较

1) 纵向比较：与自己的前后工作做比较；

2) 横向比较：与别人的工作做比较；

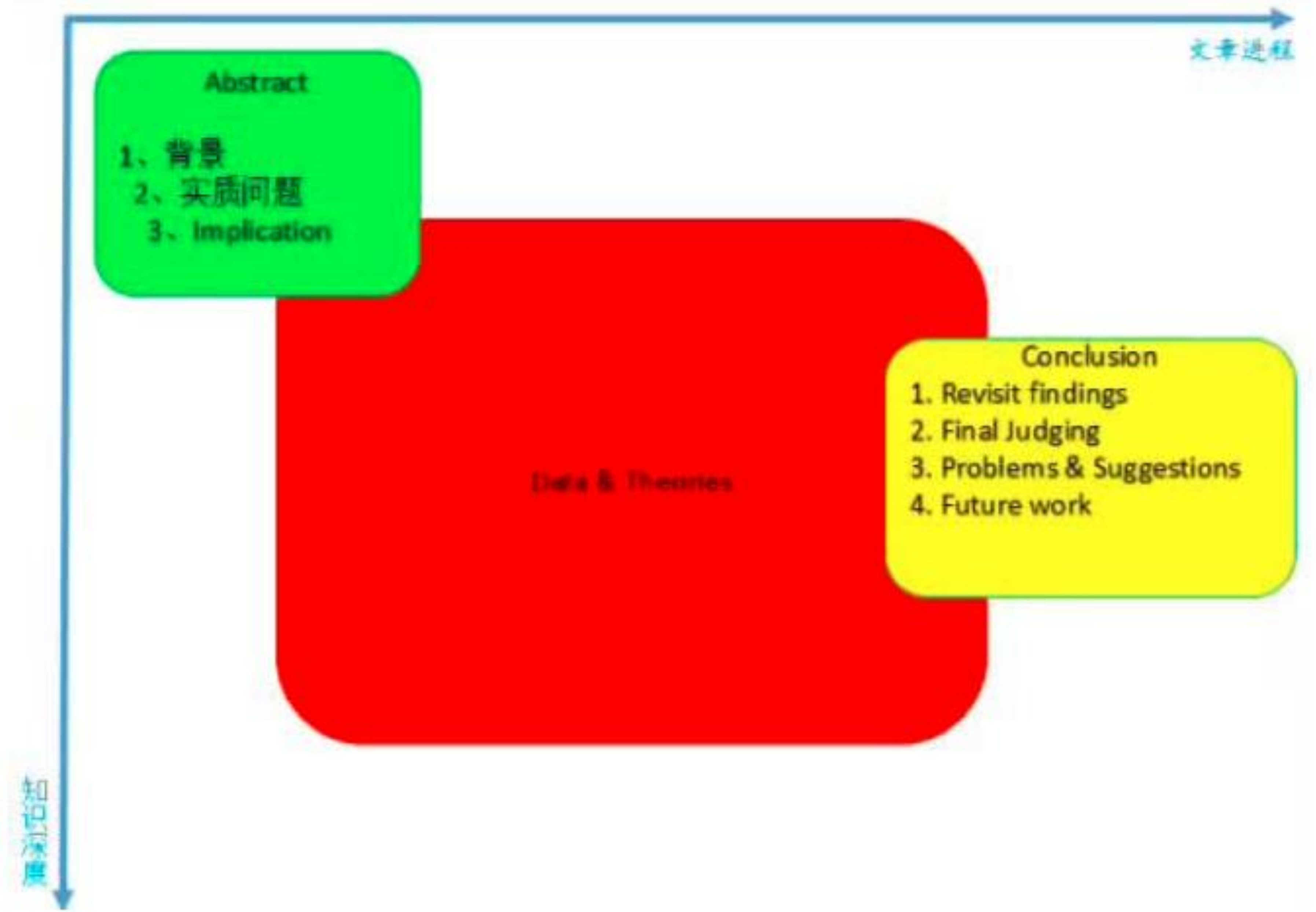
3) 回答假设问题，提出理论模型

- 讨论是研究工作的升华
  - 讨论实验是否符合预期，为什么?
  - 讨论我的工作好在什么地方? **(Advantages include…)**
  - 讨论实验中的异常现象
  - 讨论不足之处和可能的解决方案
  - 尽量用短句**(use short sentences)**

不要仅在比较底的层次上面，要解释why和how

Conclusions

- a）快速简短的总结
- b）未来工作的展望
- c）结束全文
- 把主要的结果和该工作延伸的科学以及实际意义放在这个部分里面就行了,一般是一段
- 结论和摘要要在几句话中说清楚，在几分钟内给人以深刻的印象


文章进程
Abstract
1、背景
2、实质问题
3、Implication
Data & Theories
Conclusion
1. Revisit findings
2. Final Judging
3. Problems & Suggestions
4. Future work
知识深度

- **Acknowledgements,**
- **Appendix (if any),**
- **References,**
- **Tables,**
- **Figure captions,**
- **Separate figures**

References

- 多引用综述论文、多引用经典论文、多引用最新论文、多引用高档次论文，绝对不要回避与论文密切相关文献
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- **(5) Potential Reviewers （Word文档4）**
- **(6)Prime Novelty Statement （Word文档5）**

Cover Letter

Dr. Dongdong Gu
College of Materials Science and Technology
Nanjing University of Aeronautics and Astronautics
29 Yudao Street
210016 Nanjing
PR China
dongdonggu@nuaa.edu.cn

CL第1部分：写信人、时间，收件人（英文书信格式）

October 9, 2007

Prof. Enrique J Lavernia
Dean
College of Engineering
University of California, Davis
Davis CA 95616
USA
msea@ucdavis.edu

Dear Prof. Lavernia:

首次投稿，如果你不知道是哪位主编负责你的稿件，可直接写成：Dear Editor:

Please excuse me for taking some of your time.

We are submitting our manuscript entitled "Influence of Cu-liquid content on densification and microstructure of direct laser sintered submicron W-Cu/ micron Cu powder mixture" for your kind consideration of its suitability for publication in ***Materials Science and Engineering A*.**

CL第2部分：说明你要投稿

CL第3部分：简要说明你论文的特色，引起主编的兴趣，顺利通过初审。

In this paper, direct metal laser sintering (DMLS) is innovatively used to consolidate a composite powder system consisting of submicron W-Cu powder and micron Cu powder. Using such a micron/submicron composite system not only increases the flowability and spreading property of powder mixture in powder bed, but also preserves the enhanced sinterability of ultra-fine powder component. More interesting, with a suitable amount of Cu-liquid presented, a series of regularly-shaped W-rim/Cu-core structures are formed in laser sintered components, due to the action of Marangoni flow involved in DMLS.

CL第4部分：承诺！

We hereby confirm that this manuscript is our original work and has not been published nor has it been submitted simultaneously elsewhere. We further confirm that all authors have checked the manuscript and have agreed to the submission.

CL第5部分：说明谁担任通讯作者。

I am quite willing to act as the corresponding author to handle correspondence at all stages of refereeing and possible publication. My contact information is as follows:

Address: College of Materials Science and Technology, Nanjing University of Aeronautics and Astronautics, 29 Yudao Street, 210016 Nanjing, PR China
E-mail address: dongdonggu@nuaa.edu.cn

CL第6部分：致谢，收尾。

Thank you very much for your time and consideration.

Sincerely yours,
Dongdong Gu

Potential Reviewers

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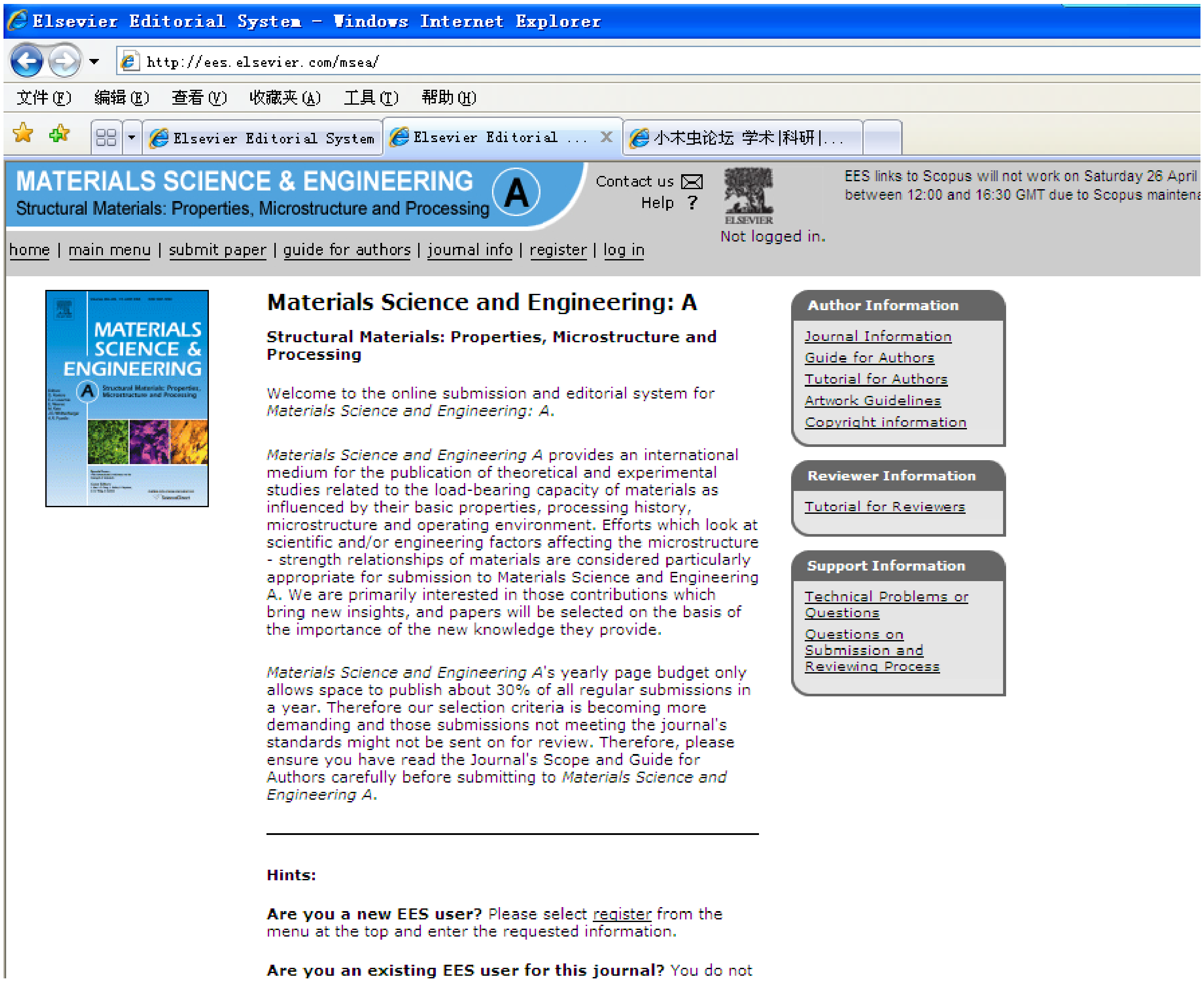

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Ref.: Ms. No. MLBLUE-D-07-01719
Formation of a novel W-rim/Cu-core structure during direct laser sintering of W-Cu composite system
Materials Letters

Dear Dr. Gu,

I am pleased to tell you that your work has now been accepted for publication in Materials Letters.

Comments from the Editor and Reviewers can be found below.

Thank you for submitting your work to this journal.

With kind regards

Prof. Heng Qiang Ye
Editor
Materials Letters

Comments from the Editors and Reviewers:

This paper presents the proof of a novel W-rim/Cu-core structure formed by laser driect sintering. It's a well-presented paper.

论文审稿4种结局之二：Minor Revision或Major Revision； 好好修改，希望很大。主编录用论文的倾向性很明显。

Ms. Ref. No.: APSUSC-D-07-01203
Title: Densification, microstructure and nanoindentation of direct laser sintered WC-10Cop/Cu nanocomposites
Applied Surface Science

Dear Dr. Dongdong Gu,

The reviewer has now commented on your paper. You will see below that the advice is that you revise your manuscript. If you are prepared to undertake the work required, I would be pleased to reconsider my decision.

For your guidance, reviewers' comments are appended below.

If you decide to revise the work, please submit a list of changes or a rebuttal against each point which is being raised when you submit the revised manuscript.

To submit a revision, please go to http://ees.elsevier.com/apsusc/ and login as an Author.
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Yours sincerely,

Frans Habraken
Editor
Applied Surface Science

Reviewers' comments:

论文审稿4种结局之三：Reject & Resubmit；好好修改，再以新的论文重投，仍有希望。重投时，需提供原先的论文编号，并详细说明你是如何做修改的。

- The Referee raises concerns, which are fundamental in nature. Your manuscript is, therefore, rejected. However, should you feel that you could respond to the Referee's suggestions, with major revisions and/or additional work; I shall be pleased to forward the manuscript to the Referee for another review. Unless the recommendation from the second review is significantly more positive, it is unlikely that I will be able to accept the manuscript. Please note that the revised manuscript must be submitted as an entirely new manuscript, which means that I will provide it with a new reference number. I would also ask you to detail in your covering letter your response to the Referee's comments.

论文审稿4种结局之四：Reject！

参照审稿人的意见，做详细修改，再改投他刊。

Ms. Ref. No.: APSUSC-D-07-02358
Title: Development of porous 316L stainless steel by DMLS
Applied Surface Science

Dear Dr. Dongdong Gu,

Reviewer's comments on your work have now been received. You will see that they are advising against publication of your work. Therefore I must reject it.

For your guidance, I append the reviewers' comments below.

Thank you for giving us the opportunity to consider your work.

Yours sincerely,

Henrik Rudolph
Editor
Applied Surface Science

Reviewer's comments:

催稿信

- Dear Prof. xxx:

  Please excuse me for taking some of your time.

  We submitted a manuscript entitled "........." (Ref. No.: ....) to Journal of ...... 3 months ago. However, we have not yet received your decision on our manuscript till now. Could you please do me a favor to check the reviewing process of our manuscript?

  Thank you very much for your time and consideration.

  Sincerely yours,
  Dongdong Gu

如何修改论文

- 投寄修改稿时，除了初次投稿时的项目，还需上传一个**Word**文档，名称**Detailed Response to Reviewers**。
- 其中包含你对审稿意见**逐条、逐点的详细回答**。
- 审稿人提出的问题，你必须**全部回答**。对审稿意见，有异议的，你**可以反驳**，但需足够的证据以及良好的反驳心态。

Dr. Dongdong Gu
College of Materials Science and Technology
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210016 Nanjing
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dongdonggu@nuaa.edu.cn

December 6, 2007

Prof. J. Daniel Whittenberger
4311 Porter Road
North Olmsted
OH 44070-2519
USA
msea_jdw@yahoo.com

Dear Prof. Whittenberger:

Thank you very much for your supervision of the reviewing process of our manuscript with the reference number of MSEA-D-07-02965 (jdw07-708). We also highly appreciate the reviewer's carefulness, conscientious, and the broad knowledge on the relevant research fields, since he/she has given me a number of beneficial suggestions. According to the reviewer's criticism and instruction, we have made the following revisions:

发件人、时间、收件人。你已知晓负责处理论文的主编，所以写信给他。

感谢主编、感谢审稿人。别吝啬你的感激之情！
同时说明你根据审稿意见，做了修改。

1. As suggested by the reviewer, we have performed the SEM characterization of the three powder systems after mechanical milling (***see Fig. 2 in the revised manuscript***). Just as the reviewer inferred, a homogeneous W-Cu mixture was obtained after milling. Here, according to the reviewer's instruction, we have used "W-Cu mixture" to describe the milled powder system, rather than the "W-Cu/Cu mixture", in order to make the relevant description more reasonable. As to the flowability of powder mixture, we have cited two important references regarding DMLS (***see Refs. [21] and [22]***) in the current manuscript to demonstrate that using a homogenously mixed bimodal-size powder bed can improve flowability of the whole powder mixture.

2. Since the reviewer has pointed out that Fig. 2 in the initial manuscript yields no novel or particular information, we have deleted this figure in the current manuscript.

3. The reviewer has pointed out that the statements over repulsion forces in the initial manuscript cannot be proved. Taking into account of the reviewer's instructions, we have found that the operative mechanisms raised by the reviewer, i.e., "particle pushing" effect during rapid solidification of the Cu melt, are quite reasonable. In this revised manuscript, we have made some necessary revisions to ***Fig. 9*** regarding the formation mechanism of W-rim/Cu-core structure. The formation of W-rim is related to the Marangoni flow, while the remaining of Cu-core is ascribed to the "particle pushing" effect during laser-induced rapid solidification (***see Lines 3-6 from top, Page 12***). In order to well define the Marangoni flow, we have cited ***Ref. [30]***. In Ref. [30], the Marangoni flow within a laser-induced solidifying system consisting of oxide particles (Al_2O_3, etc) and liquid steel is experimentally studied. The oxide/metal solidifying system, which is characterized by a considerably low mutual solubility, is similar to the W/Cu system in our study. According to Ref. [30], Marangoni flow, as a typical surface-tension-driven-flow, is induced by temperature differences (thermal Marangoni convection) and concentration differences (solutal Marangoni convection) at solid-liquid interfaces. Just as the reviewer mentioned, the sintering system during DMLS is considerably complex. Our intention in the current manuscript is to propose a reasonable explanation for the complex phenomena occurring during DMLS of W-Cu system, based on the reviewer's instructions and our understanding of DMLS.

4. According to the reviewer's criticism, we have shortened the Section of Discussion, in order to make it more concise. Some well-known knowledge regarding DMLS has been omitted in the present manuscript.

逐条、逐点回复审稿人的意见。

用一些这样的语句，以示你对审稿人意见的尊重。

详细说明你在哪些地方做了修改。

表达一下你的愿望，并致谢。

We hope that these revisions are satisfactory and that the revised version will be acceptable for publication in ***Materials Science & Engineering A***.

Thank you very much for your work concerning my paper.

Wish you all the best!

Sincerely yours,
Dongdong Gu

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