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Expert Scientific Editing Report
(Ref. US200817DF)

Title: Ultra high-resolution nanopatterning of solution-processed soft materials via nano-engineering.

Journal considered for submission: Nature Materials
Date the manuscript was received: 17 August 2020.

This report consists of 10 sections (numbered 1 through 10) and 9 pages. It starts with a general summary, which provides an overview of the strengths and weaknesses of the study, and continues by discussing in detail each part of the manuscript: Title, Abstract, Introduction, Results, Discussion, Conclusions, Experimental and Methods, References, Supplementary Information. In each section, we propose several changes and recommendations, which we believe will significantly improve the manuscript and its chances of success when submitted to the chosen journal. The report is also accompanied by a rewritten Cover Letter (see attached document), which emphasizes the novelty and importance of this study, and which clearly explains why this manuscript should be considered for review in this journal.

1. Summary

This manuscript describes a new method to produce nanostructures in soft materials (polymers and colloids) by using capillary forces in thin liquid films. The method is demonstrated with three different materials, and is used to produce field-effect transistors (OFETs) which achieve a much higher charge-carrier mobility than previously measured in the same materials.

The manuscript is well written, the experiments are properly carried out, making good use of a number of complimentary techniques, and of a large set of samples. The work demonstrated is important to the field of solution-processed electronics in general, and OFETs in particular, and the results are convincing and show a clear enhancement in charge-carrier mobility.

Overall, this is a study which has the potential to pick the interest of the editors of Nature Materials, but which would benefit from a number of modifications and improvements, as discussed in detail in this report. **One main concern** is that the novelty and importance of the study is not made clear right away in the title and in the abstract. This is the first thing to remedy in order to catch the editors' attention, and to not end up in the "rejected" pile at pre-screening. We discuss in detail how to improve the title and the abstract in sections 2 and 3.

Strengths of the manuscript

- The method demonstrated is elegant and, to the best of our knowledge, it is novel and has not previously been used in the field of solution-processed electronics.

- The different methods selected to characterize the structures and the OFETs' characteristics are properly used, and complement each other well.
- The authors have done a thorough study using a large set of samples, and demonstrated the patterning method in three different and important electronic materials, which shows the reproducibility, versatility and usefulness of the method.
- The patterning method was successfully applied to build OFETs, and it enabled a 10-fold increase in charge-carrier mobility.

Weaknesses

- Although generally well written, several sections of the manuscript are too unfocused and repetitive, and risk to quickly bore the editors and the reviewers alike.
- The importance of the work and its potential as a game-changer in the field of solution-processed electronics is not made clear right away (in the title and in the abstract).
- The Title, the Abstract and the Introduction, which are the first sections that the editors and reviewers will usually read should be restructured, shortened, and be written in such a way that it retains the attention and interest of the readers. We suggest several modifications to these (and other) sections of the manuscript in the following pages.

Other issues

- Some of the references in the introduction were incomplete, and they should be updated. We also propose three new references that the authors should consider adding to the manuscript. See p.9 for more details.
- In Figure 2, the legend referred to the incorrect panel (see p.5). Moreover, Figures 3b and 3c could be made much more convincing by showing the data for all three materials investigated in this study. This would support the statements made on p.2 and p.3 of the manuscript regarding the versatility and reproducibility of the method.
- The Experimental/Methods section should provide more detail regarding the conditions of formation of the patterns (e.g. concentration of the solutions, temperature used, and surface treatment before drop-casting), in order to allow replication of the study and reproduction of the results by other researchers. Alternatively, these experimental details can be included in the main text (e.g. in the Results section).
- Since the method shown is dependent on the spreading of the liquid and its controlled evaporation, we suggest adding data showing how the evaporation rate varies as a function of the surface energy of the surface (e.g. for the different surfaces used in this study). This would add more substance to the claim that the method enables controlled formation of nanopatterns.

Other journals to consider for submission

- We feel that this manuscript lacks a clear message, and is a little too unfocused in its current form. The comments and suggestions found in this report will help you clarify and strengthen your message, and help you catch the attention of the editors at the pre-screening stage, and the interest of the reviewers once sent in review. We believe the revised manuscript (following our recommendations) will have a much better chance of getting in review, and potentially be accepted for publication in this journal.
- We would moreover like to suggest two other journals in which this work would have a very good chance of being published (and possibly more quickly than in the chosen journal). Because the current study deals with a fair amount of materials' processing, nanopatterning and materials characterization, we believe it will strongly appeal to the readership of Advanced Materials and ACS Nano, and that it matches very well the type of research, and the quality of results, typically published in these journals.

2. Title

The title is the first thing the editor and the reviewers will read, and sometimes also the last if it does not manage to attract their attention right away! The title should therefore be chosen wisely and send a clear message about what the study is about, and why readers should care. It should be concise, enticing and convey the right message to the desired audience.

The present title is descriptive of a method to achieve ultra high-resolution nanopatterning of soft materials, and suggest that it is mainly a method-oriented paper (with no specific application in mind). There is a good use of several important keywords (e.g. high-resolution, solution-processed, soft materials) which will make it easier to search in journal databases, and which narrows down the potential readership to an audience mainly interested in nanopatterning and solution processing of soft materials.

However, considering the chosen journal (Nature Materials), this title does not convey a clear message about what is novel, exciting or unexpected, and how this work could potentially be applied to solve an important problem. The title should communicate more clearly what are the strengths of the study, and the importance of their implications (e.g. for electronic materials and OFETs). Moreover, the title is a little long and it could be improved by shortening it, removing non-essential words, and making it more enticing so that the editors will want to read more.

For example, the word “nano-engineering” is rather vague and it does not enlighten the reader as to what is meant. It could either be removed, or replaced by a more descriptive word, e.g. which describes the type of engineering more precisely. Moreover, the hyphen is not necessary here between “nano” and “engineering”. Hyphenation between two words is normally used when these come before a noun they modify and act as an adjective (e.g. solution-processed materials). Here, we suggest using the word “nanoengineering” rather than “nano-engineering”.

The word “ultra” is maybe not absolutely essential, and could be replaced by a more specific word describing the dimensions of the nanopatterning achieved, or simply be removed. Since the title mentions “high-resolution”, it is not clear whether “nanopatterning” is necessary, and it could simply be replaced by “patterning”. The authors should also decide whether “soft materials” is essential here. We believe it would be better to replace “soft materials” by a more precise description of the materials (e.g. electronic materials) used in order to convey a clearer idea of which audience is targeted.

Moreover, in order to really attract the editors’ attention, we suggest the authors reword the title in order to **convey more clearly the novelty and importance of this work, and what really stands out**. After reading the whole manuscript, three things stood out for us:

1. the high resolution achieved over large areas by the new method;

2. the versatility of the patterning which can be applied to three well-known functional materials used for building OFETs;

3. the significant enhancement in charge-carrier mobility, resulting from the formation of the nanopatterns.

We therefore invite the authors to come up with a new title which highlights one or several of these strengths. Because the manuscript discusses in detail several important aspects of the study (the new method and the high-resolution achieved, but also its application to electronic materials, and how it enables high charge-carrier mobility), the authors need to decide which message they want to convey to the readers. Should the title focus on the new method, on the results, or a combination of both?

In order to help you get started, we propose three examples of titles which each focus on a different strength from the study. The first two titles focus more on the patterning method, while the third one focusses on the results, and emphasizes the potential of the new method to impact the field of OFETs.

1. Large area sub-30 nm patterning of functional electronic materials via capillary force engineering

2. High-resolution capillary force nanopatterning of functional electronic materials

3. 10-fold increase in OFET charge-carrier mobility via high-resolution capillary force patterning

3. Abstract

The aim of the abstract is to inform the reader about the content of the paper by summarizing and highlighting the important aspects of the paper:

- the purpose of the research,
- the problem or question addressed,
- the methods used,
- the main results and conclusions.

Remember that the title and the abstract may be the only sections the editors will read, and then decide whether the paper should be sent for review. It is therefore important to make it concise, attractive, and to stress out the novelty and importance of the work. It is also common to end the abstract by briefly commenting on the broader considerations/implications of the results and conclusions.

The current abstract is overall well written, but it does not convey well enough the importance of this study, and its potential impact in the field of solution-processed electronic materials, especially concerning OFETs. The first two sentences are unnecessary here, and would better fit in the introduction. This would also shorten the abstract, make it more to the point, and entice the editors to continue reading the rest of the paper. The abstract should moreover make good use of important key words, and we suggest that the authors ...

... **(end of this excerpt).**