Dear Prof. Zhang,

Thank you for your e-mail with the reviewers' comments and suggestions. We have revised this manuscript carefully according to the reviewers' comments and suggestions.

For answering the comments, we made some changes and marked them in the revised manuscript. All the responses to the comments and suggestions from the referees point by point were integrated into this response letter. Please see the details as follows.

The revised manuscript with changes and marks was also uploaded as a supplementary file for reviewers.

Your consideration would be much appreciated.

We expect the current format can meet the requirements of "*Nanomaterials.*"

With my best regards,

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Reply for Reviewer #2:

Open Review	(x) I would not like to sign my review report ( ) I would like to sign my review report
English language and style	( ) Extensive editing of English language and style required ( ) Moderate English changes required (x) English language and style are fine/minor spell check required ( ) I don't feel qualified to judge about the English language and style

	Yes	Can be improved	Must be improved	Not applicable
Does the introduction provide sufficient background and include all relevant references?	( )	(x)	( )	( )
Is the research design appropriate?	( )	( )	(x)	( )
Are the methods adequately described?	( )	( )	(x)	( )
Are the results clearly presented?	( )	(x)	( )	( )
Are the conclusions supported by the results?	( )	(x)	( )	( )

General Comments: This manuscript presents a kind of polyaniline@cellulose (PANI@CNs) nanowhiskers having a high aspect ratio and excellent solubility in 1,4-dioxane. It showed s superior conductivity and high mechanical properties. Especially, Cellulose nanowhiskers (CNs) were used for the most promising biomaterials. I think it's slightly contradictory. Although the obtained PANI@CNs suspension exhibits excellent dispersibility in 1,4-dioxane, I'm more concerned about 1,4-dioxane as solvent in terms of a biocompatibility. It, residue solvent, causes irritation of the eyes, nose and throat in humans for short periods of time. Exposure to large amounts can cause kidney and liver damage. Moreover, it had the lack in the novelty and did not present a break-through in this area (current open paper ref. Zhijun Shi et al RSC Advances 2012, 2, 1040–1046, Xiaodong Wu et al ACS Appl. Mater. Interfaces2014, 6, 23, 21078-21085, Taku Omura et al ACS Omega 2019, 4, 9446−9452). The entire logic was insufficient: the objective, necessity, and advantages of this study must be clarified in the manuscript with further explanation.

Reply：Thank you for your review and suggestions. Before experiments on the synthesis of PANI@CN for silver-based adhesives, we have carefully read the literature on cellulose nanowhiskers (CNs). As you said, cellulose nanowhiskers (CNs) are used in the most promising biomaterials, but in recent years cellulose nanocrystals have been widely used in the field of flexible electronics. Two reviews (*J Bras et al. Nanoscale, 2016,8, 13131-13154, Pal et al. Carbohydrate polymers 2018, 198, 249-260.)* described the critical role of cellulosic materials in the fields of supercapacitors, electronic inks, and flexible circuits. Therefore, cellulose nanocrystals have been widely accepted in the field of flexible electronics.

Thank you for pointing out the safety issue of 1,4 dioxane in your review. Although dioxane and DMF are toxic and carcinogenic to humans, dioxane and DMF still have been widely used as a general solvent for dissolving TPU in the manufacture of flexible electronic devices such as conductive pastes, high sensitivity pressure sensors. (*RSC Adv., 2019, 9, 23843-23855, Compos Sci Technol. 2016, 129, 191-197, Compos Sci Technol. 2017, 149, 166-177*). The main reason is still challenging to find non-toxic and harmless, green solvent to replace dioxane and DMF to dissolve TPU. In fact, PANI@CN has excellent dispersibility in green solvents such as water and ethanol (data has been added in the manuscript in Figure S3), which helps to fabricate more environmentally friendly, high-performance electronics in the future. We believe that this issue will be fully explored and resolved in the future.

Thank you very much for your comments on the novelty of our work. As you pointed out, PANI@CN has been reported in previous literature (These highly relevant articles recommended by the reviewer were cited in the manuscript), however, to the best of our knowledge, the introduction of PANI@CN to reach superior electrical conductivity with the low fabricating cost of conductive adhesives has not been reported. we are the first to use PANI@CN to fabricate high-performance conductive adhesives, and for the first time, reported highly competitive electrical conductivity and mechanical properties of the conductive adhesive.

Thank you for your suggestions. The objective, necessity, and advantages of this study have been further clarified in the manuscript.

The objective and necessity in the study were described in the introduction of the manuscript.

"Even though ECAs have many merits, they still have a long way to meet perfectly the needs of today's flexible electronic products. The main obstacle is that current flexible ECAs usually have

limited conductivity (resistivity is usually higher than 2.0 × 10−4 Ω • cm) or need significant amounts of metal fillers to achieve reasonable conductivity. These limit the widespread applications of ECAs in microelectronics [7, 8]. Therefore, it is imperative to enhance the conductivity of ECAs with a minimized amount of metal fractions to reduce the cost and prevent brittle fracture of the ECA's patterns upon mechanical deformation [4, 9]."

The advantages in the study were described in the manuscript.

"However, to the best of our knowledge, the introduction of PANI@CN to reach superior electrical conductivity with the low fabricating cost of conductive adhesives has not been reported. ……Hence, new flexible conductive adhesives with ultrahigh conductivity and high mechanical compliance were achieved."

"As is listed in Table 2, the conductivities of PC-ECAs (PC-1) were compared with other literature ECAs. It was found that our PC-ECAs (PC-1) filled 55 wt% Ag contents has an extremely low resistivity of 3.16×10-5 Ω • cm. By comparing our data with recent work in table 2, it cleared that the electrical performances of PC-ECAs with little Ag content surpassed other literature ECAs. These properties of PC-ECAs could contribute to the goal of improving the conductivity of ECAs while reducing the proportion of high-priced metal fillers used."



Figure S3. Dispersion test of PANI@CNs (1:4) in water and ethanol