Smart Materials and Structures

Decision Letter (SMS-110481)

From: sms@ioppublishing.org

To: dr779@nau.edu

CC: dr779@nau.edu, Heidi.Feigenbaum@nau.edu, michael.shafer@nau.edu

Subject: Our initial decision on your article: SMS-110481

Body: Dear Mr Ruiz,

Re: "Moisture's significant impact on Twisted Polymer Actuation" by Ruiz, Diego; Feigenbaum, Heidi; Shafer, Michael
Article reference: SMS-110481

We have now received the referee report(s) on your Paper, which is being considered by Smart Materials and Structures.

The referee(s) have recommended that you make substantial changes to your article. The referee report(s) can be found below and/or attached to this message. You can also access the reports at your Author Centre, at https://mc04.manuscriptcentral.com/sms-iop

Please consider the referee comments and amend your article according to the recommendations. You should then send us a clean final version of your manuscript. Please also send (as separate files) point-by-point replies to the referee comments and either a list of changes you have made or an additional copy of your manuscript with the changes highlighted (for further information visit https://publishingsupport.iopscience.iop.org/questions/how-to-prepare-your-revised-article/). This will aid our referees in reviewing your revised article. Please upload the final version and electronic source files to your Author Centre by 04-Aug-2020.

If we do not receive your article by this date, it may be treated as a new submission, so please let us know if you will need more time.

Please note that if the referee(s) and Editorial Board are not satisfied with the changes to your manuscript, it may still be rejected.

We look forward to hearing from you soon.

Yours sincerely

Philip Semple

On behalf of the IOP Peer Review Team
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REFEREE REPORT(S):
Referee: 1

COMMENTS TO THE AUTHOR(S)
- This paper investigated moisture's impact on Twisted Polymer actuator (TPA), especially, Straight Twisted Polymer Actuator (STPA). Typically, actuating principle of TPA is based on temperature not a moisture. The approach of this paper that analyze the effect of moisture on TPA might be significant issue. However, the evaluation seems to be insufficient.
1. The evaluation of STPA is insufficient. Although, the contractile strain, modulus are evaluated qualitatively, the evaluation of torque that STPA can generate is also required. The torque change according to not only the moisture absorption, but also the temperature change.
2. In this paper, a STPA with a 36° pitch angle is used. However there is no explain about why 36° pitch angle is used. The evaluation of STPAs with various pitch angle is also necessary.

Minor comments
1. In caption of Figure 1, the temperature of phase 3 might be "70℃ ".
2. In second paragraph of chaper 3.2, the first word might be "In as much".

Referee: 2

COMMENTS TO THE AUTHOR(S)
The manuscript from Diego et al, brought an interesting approach to understand the impact of moisture on the actuation of Straight Twisted Polymer. It is found that the torsional actuation responses under free torsional conditions for a pitch angle of 36 degrees and shown that moisture absorption can cause a similar untwist response as seen when a thermal load is applied. The topic is interesting and fitting well to the scope of Smart Materials and Structures. There are great potentials in moisture driven morphing of soft matter based structure. After reading the manuscript, I would suggest that the following questions need be answered before considering this submission to further stage.

–Figures 1 – 4 focus on describing the experimental set up. There is nothing wrong on the figures, however, I was wondering if authors could provide more scientific insights, such as the themo-dynamics, surface physics or mechanics models/ equations, alongside with the possible hypothesis on molecular structure/ phase changes?
– The moisture driving actuation of polymer structure has been quantified, but the analytical interpretation is very limited, a significant gap left toward the understanding of this phenomenon, i.e. how's relationship between the moisture percentage to the actuation? Any analytical views on controlling of actuation with different geometrical variations?
– The actuation mechanism has been poorly explained, a hypothesis is far from enough. I would consider a mechanics simulation as satisfactory but can live with some simple scaling at this stage.
– The writing format in this manuscript general looks more like an engineering report. I would recommend authors to revise accordingly to a higher standard with an improved scientific interpretation.

In conclusion, a major revision and resubmission is needed according to above comments.

Referee: 3

COMMENTS TO THE AUTHOR(S)
The paper is investigating the effects of moisture content on Straight Twisted Polymer actuators fabricated from Nylon 6,6. The material and thermal properties of the precursor fiber were investigated where the axial mechanical modulus and axial thermal contraction are shown to have a great dependency on moisture content. The authors further their case by showing that the straight twisted polymer actuator can actuated with hydration alone. The authors give a detail explanation on the theory of how and why the hydration has such a significant impact on the actuator through a Fickian diffusion and relaxation process perspective. The authors did a good job with this study and make a good case on how hydration significantly change the characteristics of STPC's, something that has not been widely explored in the field of TCP's.

The paper is well written. A few things for the authors to consider are:
1-The title is a little misleading. A title recommendation would be "Moisture's significant impact on Straight Twisted Polymer Actuation," so the readers are not expecting results on the TCPA.
2-Abstract, paragraph 1:
3-2.2. Free torsion hygroscopic actuation experimental set-up:
State what the fiber material is and the dimension.
4-Figure 2:
Collet is spelled wrong, says "Collect."
5-2.3. Axial thermal contraction
Does the 9g mass have any effects on the axial thermal expansion results? The axial modulus is a function of temperature and may cause displacement errors.
6-3.3 Moisture content effects on axial thermal contraction, ϵ_11^T, and axial elastic modulus, E_1.
grammar error: "…the latter shows and increase in axial thermal contraction six times…" change and to an.

Letter reference: DSMa01

Date Sent: 07-Jul-2020

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