

ANSWERS TO COMMENTS ON THE MANUSCRIPT [30] ("ADHESIVE TAPE", AUSTRIAN IYPT TEAM)

Answers to reviewer 1:

Q1. The pull-off angle is obviously not constant with the experimental method used.

A1. The experiments do not intend to keep the angle constant. As formula [6] indicates, the argument used in this paper is that the angle influences the force necessary to pull off the tape. This was verified by the experiments.

Q2. Equation [2] seems to be a vector equation and I don't believe it is true even then.

A1. I added the accents. As explained, the total force was separated into a horizontal and vertical component. The only loss of energy can be seen as the stretching of the tape. Since the upwards component will still pull off the tape even when there is stretching of the tape, it can be considered as the component responsible for pulling only. The vertical component then is responsible for stretching the tape.

Q3. I do not understand equation [5]. It seems to involve energy differences but the right-hand members are not differences. I don't understand where $\Delta EPot2$ comes from and it involves an unknown quantity mS . The following formula for γ has apparently been derived by setting $\Delta EPot2 = 0$ but this is not stated. It is not clear how the result is used later on. I find it hard to believe that the surface energy of the tape, an intrinsic property would depend on all these external parameters.

A3. Further descriptions of the formula and a graphic for visualization were added. (Page 4)

Q4. Formula [6]. From where does it come? It is definitely wrong. Neglecting elastic energy there should be a denominator $(1 - \cos \alpha)$.

A4. The critical force[N] to pull of the tape composes from the surface energy γ [N/m] times the width[m] of the tape. The angular dependence has been considered by the sine of the pulling angle.

Answers to reviewer 2:

Q1. Limitations of the proposed approach should be discussed (is the angle of pulling the only parameter answering the problem of necessary force? What with other properties of the system?)

A1. As explained in the chapter "Assumptions and Limitations to the Theory", we found two parameters to be relevant for the minimal pulling off force: surface energy and Young's modulus (straining of the tape). Any other parameters would influence these two. (e.g. different tape -> change in Young's modulus; different surface -> change in surface energy) The chapter "Assumptions and Limitations to the Theory" points out these aspects and explains that these varying parameters can be inserted in the given theory but in order to limit the number of experiments they have not been changed for the experiments in this paper and only qualitative explanations are given.

Q2. Page 4: the equations are littler unclear (mention, that $E0$ is a total surface energy, etc.)

A2. The equations are now described further. (See also: reviewer 1, A3)

Q3. (e.g. that only horizontal force component is stretching the tape, which in general is not true),

A3. See Answers to reviewer 1, A2

Q4. Only one parameter (angle) is mentioned as crucial

A4. See A1 (reviewer 2).

Q5. The proposed model does not take into account the dependence on velocity, which is suggested by experiments.

A5. The dependence on velocity has been considered in the experiments as can be seen in figures 8 – 11. Within the description of those figures, it was also explained why the minimal force is considered to exist in the static case. In “Assumptions and Limitations to the Theory”, the reason for choosing low velocities is explained.

Q6. Other parameters and other tapes were not studied.

A6. See A1 (reviewer2).

Q7. Describe a slip-stick problem briefly and add some references to it (page 3, top)

A7. A short definition was added with an according reference.

Q8. Why only one type of tape was used? it should be described more clearly.

A8. Description in “Assumptions and Limitations to the Theory”

Q9. Attach a chapter (five sentences approx.) with a discussion of limitations of your solution (the description of limitations is scattered through the article)

A9. Description in “Assumptions and Limitations to the Theory”

Q10. References:

The number of used references is small. In the first reference (Ciccotti et al.) it is unclear, if the reference is a book or journal (please add more information – journal name, page numbers, publisher of the book etc.). The second reference lacks the page number specification.

A10. I tried to fix this as well as possible: Ciccotti is cited the way I found it in other papers; K. Kendall’s paper has been published in a journal.

Answers to reviewer 3:

Q1. In the Assumptions section, I would use "surface tension" instead of "surface energy". Furthermore, I'd like to see a 2-sentence description of the stick-slip regime you'd like to avoid.

A1. Both suggestions have been included in the paper.

Q2. The Theory section severely lacks clear pictures with where the forces are acting, leaving the reader guessing (and almost unable to check the formulae).

A2. Figure 4 has been included to solve the difficulties.

Q3. When determining Young's modulus, you could write in which experimental setup you will use (point the reader to the appropriate figure).

A3. Accomplished.

Q4. Later, it is not clear how you determined the size of the layers and tested your guess for the optimal crack size.

A4. It has been pointed out in the chapter "Assumptions and Limitations to the Theory" and also mentioned within the description of the impact of crack sizes on the surface energy, that this is only a qualitative assumption that has not further been proved experimentally.

Q5. The energetical considerations formulae lack descriptions, and leave the reader guessing what E_D is... the stretching?

A5. Further information has now been included for formula [5].

Q6. The next section "Experimental" should be called "E. setup/results"

A6. The name was changed.

Q7. Why did you do your experiments over 5 days? Didn't this "tire" the the glue?

A7. In order to be able to use energy conservation to find the value for gamma, the experiment lasted 5 days. (Explanation included in the paper.) Due to the fact that there was no movement anymore for 1 day before ending the experiment, the glue seemed to be fine.

Q8. What are the dimensions of gamma?

A8. N/m (included in the derivated formula from equation [5])

Q9. More interesting are Figures 8-10. I wonder why they don't go to 90 degrees.

A9. With the experimental setup, we were not able to maintain a constant speed rate at the beginning of the experiments. It is now mentioned in the paper.

Q10. Furthermore, what is the "theoretical prediction", is it with the same gamma? Or is gamma adjusted? How come you then "predict" it? Aren't you just fitting $\text{const}/\sin(\alpha)$ through the data?

A10. The word "prediction" referres to the plot in Fig. 8: the development of the force according to the angle (it is now explained more precisely in the paper). Yes, gamma has been derived from the experiment. The values for the critical force then could be predicted with this achieved value.

Q11. Small typos

A11. Typos were corrected.

Editorial Requests

Q2. Figure 1: consider adding a scale bar.

A2. Accomplished.

Q2. References: Please type the references in a way that the readers may immediately understand where and how they may look for a document. Add volumes and journal titles.

A2. See reviewer 2, A10.