

Physical Review Letters

Prof. Dr. Jens Harting
Forschungszentrum Jülich GmbH
Helmholtz Institute Erlangen-Nürnberg
for Renewable Energy (IEK-11)
Dynamics of Complex Fluids
and Interfaces
Email: j.harting@fz-juelich.de
www.hi-ern.de

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Dear editor,

it is our pleasure to submit our manuscript “Controlling the dewetting morphologies of thin liquid films by switchable substrates” as a contribution to Physical Review Letters.

Dewetting of thin liquid films poses an important scientific and industrial problem. From an industrial point of view there are two extremes. While the process of coating requires the film to be stable, self-cleaning devices should dewet as fast as possible. Theoretically, the problem can be treated using the thin film equation. Recently, breakthroughs in surface modification paved the way for so-called switchable substrates. The key advantage of these substrates is the control of wettability through external stimuli such as light. This makes them perfect candidates for a new generation of open microfluidic devices.

In our work we demonstrate that spatio-temporal varying stimuli on the wettability are sufficient to create novel dewetting states. We first show by means of numerical simulations that these stimuli enhance the film stability and provide a scaling argument based on theoretical derivations. Secondly, by variation of the temporal signal we observe a morphological transition. The transition can be explained using a dimensionless quantity measuring film retraction and wetting velocities.

Our contribution provides a self-contained analysis of a fluid dynamics problem with a high degree of novelty and should be of interest to the general readership of Physical Review Letters. To the best of our knowledge this transition and the emerging rivulets have not yet been observed in dewetting experiments. However, given the visibility and reach of Physical Review Letters, we expect experimental groups to develop an interest in these phenomena and to confirm our findings in the lab.

Thank you for your time and consideration. We look forward to hearing from you in connection with our submission.

Yours sincerely,

Stefan Zitz, Andrea Scagliarini and Jens Harting