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● Numerical modelling of large stretch of adhesive fibrils

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Abstract content

In a pressure-sensitive adhesive (PSA) tape, adhesion rupture is accompanied by fibrillation and cavitation of the adhesive layer. In this study, we propose a multiscale picture of adhesion rupture, involving a better understanding of fibrillation. Numerically, a single fibril is modeled using the Finite element method using axis-symmetric boundary conditions. An Arruda Boyce, hyperelastic constitutive law is employed to tackle the large strains associated with the computer modeling of the layer of adhesive. Apart from Arruda Boyce, we are using other relevant constitutive relations like the Yeoh model, as well. We found that peeling a single fibril from a bulk of adhesive requires five times more work than the uniaxial extension of the fibril for the same patch diameter in the numerical study, which is true for peeling experiments previously done at the SIMM lab.[1] In addition to that, we are also studying Cavity expansion along with the fibril and we want to connect these two phenomena happening in PSAs. Our final aim is to connect the macroscopic work of fracture and the dissipative properties of the PSA material through a proper description of the large strain deformation of the interface.

Acknowledgement

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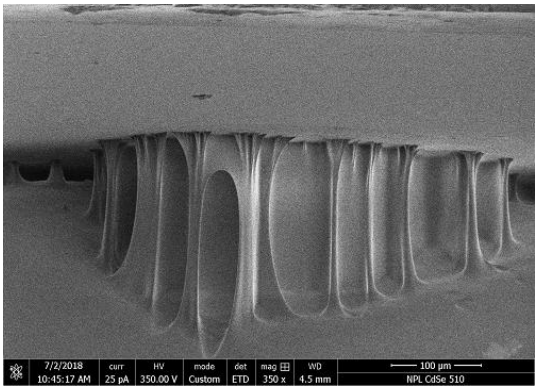
References

[1] Nonlinear Viscoelastic Modeling of Adhesive Failure for Polyacrylate Pressure-sensitive Adhesives; Macromolecules; J.Chopin et.al; 2018

SEM view of fibrillation (X. Morelle & B. Bresson)



FEM simulation of a fibril (axisymmetric)