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Thin film buckling : a relation between adhesion and morphology

ETIENNE BARTHEL, JEAN-YVON FAOU, SERGEY GRACHEV, CNRS/Saint-Gobain, GUILLAUME PARRY, Simap CNRS/UJF/INP Grenoble — When thin films with low adhesion are compressively stressed, they may buckle. These buckles exhibit interesting morphologies such as the well known telephone cord. However our understanding of this form of buckling is limited because it couples the large displacement nonlinearities of plates with the subtleties of mixed-mode adhesion. Here we investigate the morphology of the thin film buckles as a function of mode mixity by a combination of experiments and simulations. We first exhibit a linear relation between the period of the telephone cord buckles and a characteristic parameter of the mixed mode adhesion. Furthermore we evidence a rich set of new buckle morphologies through experiments, and demonstrate that these morphologies can be reproduced in the simulations. We also show that we can rationalize the transitions between morphologies through a phase diagram. This excellent agreement between experimental results and numerical predictions further validates the simulation method we have developed recently.

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