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Tension-induced binding of semiflexible biopolymers[1] PANAYOTIS BENETATOS, Dept. of Physics, Kyungpook National University, Rep. of Korea, ALICE VON DER HEYDT, Inst. for Theoretical Physics, University of Goettingen, Germany, ANNETTE ZIPPELIUS, Inst. for Theoretical Physics at University of Goettingen and Max-Planck Inst. for Dynamics and Self-Organization, Germany — We investigate theoretically the effect of polymer tension on the collective behaviour of reversible cross-links. We use a model of two parallel-aligned, weakly-bending wormlike chains with a regularly spaced sequence of binding sites subjected to a tensile force. Reversible cross-links attach and detach at the binding sites with an affinity controlled by a chemical potential. In a mean-field approach, we calculate the free energy of the system and we show the emergence of a free energy barrier which controls the reversible (un)binding. The tension affects the conformational entropy of the chains which competes with the binding energy of the cross-links. This competition gives rise to a sudden increase in the fraction of bound sites as the polymer tension increases. The force-induced first-order transition in the number of cross-links implies a sudden force-induced stiffening of the effective stretching modulus of the polymers. This mechanism may be relevant to the formation and stress-induced strengthening of stress fibers in the cytoskeleton.

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