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Stretching Tethered Polymer by Traveling Wave Electric Fields HSIEN-HUNG WEI, YENG-CHIN LI, TEN-CHIN WEN, National Cheng Kung University — In this work, we theoretically explore the use of traveling wave electric fields in stretching a charged polymer chain whose one end is pinned at a surface. A simple elastic dumbbell model is employed to elicit the essences of the stretching. In a simple sinusoidal field, the chain merely stretches and contracts back and forth with a zero cycle-averaged extension, as expected. In a traveling electric field, on the contrary, the chain can be periodically pulled by subsequent strokes of the field without being fully contracted, and therefore can exhibit some extension during a cycle. And yet, the chain will not stretch at all if the field travels too fast. The detailed response would depend on the Deborah number, the ratio of the elastic force to the stretch force, and alpha, the ratio of the traveling field speed to the characteristic electrophretic velocity of the chain. We not only show how the stretching is characterized by these parameters, but also provide the criteria for realizing the stretching in terms of electrode dimensions, the chain size, and the strength and frequency of an applied traveling field. A possible application to molecular sensing is also discussed.

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