High speed treadmilling of actin filaments
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Purified actin filament polymers treadmill slowly by concentration-dependent addition of subunits at their ‘plus’ ends, and inherently slow dissociation of subunits at their ‘minus’ ends. We have defined a novel mechanism in which two proteins (Twf1 and Srv2/CAP) interact to accelerate depolymerization of filaments at minus ends by 20-fold. This has allowed us to reconstitute and directly visualize (using TIRF microscopy) actin filaments undergoing tunable, accelerated treadmilling, with formins and profilin catalyzing polymerization at plus ends and Twf1-Srv2 catalyzing depolymerization at minus ends. Filaments are first polymerized using actin monomers (purple), and then actin monomers of another color (teal) are introduced along with Twf1-Srv2. This mechanism also catalyzes actin filament bundle depolymerization.