Application of Nonequilibrium Thermodynamics to Polymer Collapse Dynamics

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Nonequilibrium thermodynamics plays important roles in explaining various nonequilibrium processes. Various nonequilibrium theories and methodologies such as the fluctuation theorem have been developed but there still remain some difficulties in locally measuring thermodynamic properties such as energy, entropy, and the free energy in the nonequilibrium process. Recently, Jinwoo and Tanaka [Ref: Sci. Rep. 5, 7832 (2015).] provided a formalism (the JT formalism) for the local thermodynamic properties, which are expressed as the path-ensemble of local microstates over time. Herein, we investigated the JT formalism by applying it to the polymer collapse dynamics as an exemplary nonequilibrium process. We did not only verify the nonequilibrium thermodynamic relations among the local nonequilibrium variables derived in the JT formalism by additional derivations with mesoscopic variable, but we also show validity of relations for the equilibrium properties obtained by nonequilibrium local properties related with JT formalism.