# A Gradient Flow Perspective for Weak Solutions of the Mullins-Sekerka Flow and an Application to Lithium-Ion Batteries

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The purpose of this talk is to develop a gradient flow perspective for the Mullins-Sekerka equation, intrinsic to the evolving surface, at the level of a weak solution theory. The solution concept is motivated by the De Giorgi framework for curves of maximal slope and consideration of $\Gamma$-convergence for gradient flows in the spirit of Sandier and Serfaty. Solutions must satisfy an optimal energy dissipation relation, where both the time derivative and metric slope are considered with respect to formal tangent spaces, arising from the mass preserving normal velocities. We prove that such solutions exist, may be recast in a PDE sense, and subsume the solution concept introduced by Le in the study of $\Gamma$-convergence for the Cahn-Hilliard equation. As an application, we explore how a related solution concept can be used to understand the sharp interface limit of the Cahn-Hilliard reaction model for phase separation in lithium-ion batteries. Joint works with Sebastian Hensel (U. Bonn) and Tim Laux (U. Bonn).