

REGULARITY FOR DEGENERATE TWO-PHASE FREE BOUNDARY PROBLEMS

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We provide a rather complete description of the sharp regularity theory for a family of heterogeneous, two-phase variational free boundary problems, $\mathcal{C}_\gamma \rightarrow \min$, ruled by nonlinear, degenerate elliptic operators. Included in such family are heterogeneous jets and cavities problems of Prandtl-Batchelor type, $\gamma = 0$, singular degenerate elliptic equations, $0 < \gamma < 1$, and obstacle type systems, $\gamma = 1$. Linear versions of these problems have been subjects of intense research for the past four decades or so. The nonlinear counterparts treated in this present work introduce substantial new difficulties since most of the classical theories developed earlier, such as monotonicity and *almost* monotonicity formulae, are no longer available. Nonetheless, the innovative solutions designed in this article provide new answers even in the classical context of linear, nondegenerate equations.

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