A new and extended version of a generic modeling framework for analysis and design of crystallization operations is presented. The new features of this framework are described, with focus on development, implementation, identification, and analysis of crystallization kinetic models. Issues related to the modeling of various kinetic phenomena like nucleation, growth, agglomeration, and breakage are discussed in terms of model forms, model parameters, their availability and/or estimation, and their selection and application for specific crystallization operational scenarios under study. The advantages of employing a well-structured model library for storage, use/reuse, and analysis of the kinetic models are highlighted. Examples illustrating the application of the modeling framework for kinetic model discrimination related to simulation of specific crystallization scenarios and for kinetic model parameter estimation are presented.