



The Freezing Stage in Freeze Drying: Fundamental Concepts

ABSTRACT:

The first step of the freeze drying process involves freezing of a solution to convert most of the water into ice, leaving the solute in a glassy and/or crystalline phase.

An important goal of the freezing step is to produce a homogeneous batch with regard to the ice crystal size distribution. The ice crystal size determines the product morphology which, in turn, impacts ultimately the resistance to mass flow and therefore primary drying time. Controlled freezing is, however, challenging because of the random nature of nucleation.

The ice nucleation temperature, T_n , is quite variable even in a well-controlled process. Interval variation in nucleation temperatures causes heterogeneity in drying behavior, which can impose significant process control problems in the primary drying stage.

The scope of this webinar is to provide a brief insight into the fundamental concept of the freezing stage in a freeze drying cycle. Topics such as annealing or technical solutions to better control the nucleation process during the freezing step will be covered.