Since the 1980's, a traditional way to represent ice processes in cloud models using both bulk and bin microphysics schemes has been to divide ice particle populations into predefined categories such as pristine ice, snow, graupel and hail. Such methodology is rooted in the bulk representation of warm-rain microphysics, where there is a clear demarcation of growth processes between cloud droplets and drizzle/rain drops. For ice particles, however, such a demarcation is not obvious and particles of a given size can grow by different processes including vapor diffusion, aggregation, and riming. Thus, conversion from one ice category to another in traditional schemes has no solid theoretical or empirical basis and is generally represented by nonphysical, arbitrary (or tuned) thresholds and/or conversion rates. Motivated by such concerns, a novel approach has been proposed in recent years that is based on separately predicting mixing ratios of ice grown by water vapor diffusion and by accretion (riming), in addition to predicting the ice number concentration. This approach allows for smooth transition between different particle types and avoids unphysical thresholds and conversion rates. Microphysical process rates are calculated self-consistently based on particle mass-dimension and projected-area dimension relationships that evolve with the predicted diffusion and riming mixing ratios and number concentration. This approach was initially employed in a bulk scheme and recently extended to a new bin scheme. Details of the approach and examples of idealized and real case simulations using the bulk and bin schemes will be presented.