9504

Growth Kinetics of Sodium Chloride in Industrial Crystallizers

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In industrial crystallizers, crystals are usually grown in suspension. It is needless to say that size of product crystals is influenced not only by molecular level crystal growth mechanism but also by abrasion and agglomeration mechanisms, etc. Consequently, it would be useful from an industrial point of view to regard "crystal growth" in crystallizers as a combined phenomenon of those which influences the size change of crystals.

In a previous study [M. Yokota et al., AIChE J., Vol. 42, No. 5, 1487-1490 (1996)], we reported that sodium chloride crystals exhibited an interesting "growth" behavior. That is, regularly arrayed fine crystals (RAF) appeared on the surface of commercially produced crystals (CPCs) during growth. In this study, we examined formation mechanism of RAF.

Formation kinetics of RAF.

The CPC has originally very rough surface. We could not find origin of RAF on the surface. A CPC was grown in clear solution and change of the surface topograph was observed *in-situ* with a laser microscope. The original rough surface became smooth within a short period of growth and some origins of RAF appeared on the surface. With progress of growth, the origins were combined each other and RAFs developed. Next we examined recrystallized seed crystals (RC, spontaneously produced crystals in stagnant solution), which have originally smooth surfaces. When RCs were suspended in a fluidized bed, the surface became rough by abrasion. On the abraded RCs, RAFs appeared during growth in a clear solution. From the result mentioned above, it was concluded that RAFs were formed during the course of improvement of the abraded rough surface. Additionally, supersaturation was found to affect the degree of formation of RAFs.

In the next section, we examined the effect of suspended fine crystals on the growth of RC.

Adhesion of suspended fine crystals to RC and the role of the fines on the growth.

When a RC was allowed to grow in clear solution, the surface of the RC was maintained to be smooth. However, some fine crystals were observed to adhere on the surface of the RC, when a RC was grown in the presence of suspended fine crystals. Fine crystals, appeared on the surface of RC revealed two kinds of behavior: some of the fine crystals were burying into the seed crystals, while the others were developing on the surface of seed crystals.

Growth rate of RC was promoted by adhesion of fine crystals. This might be attributed to the appearance of active macro steps originating from cracks generated around the fine crystals.