Growth and Agglomeration of Sodium Chloride Crystals in the Suspension of Fine Crystals

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Sodium chloride crystal sometimes exhibits peculier growth behavior, that is , regularly arrayed fine crystals (RAF) appear on the surface of the growing crystal. Although the crystal growth of sodium chloride has been studied by many investigators so far, only a few have paid attention to RAF. In this study, we show expérimental evidence of the formation kinetics of RAF observed with scanning electron microscopy (SEM). We prepared two kinds of seed crystals: recrystallized seeds (seed A) and commercially produced crystals (seed B). Seeds A and B were allowed to grow in clear solution of sodium chloride in a flow cell. After a while, the seed crystal was taken out from the cell and the surface was observed with SEM. The some growth experiment was carried in the presence of suspended fine crystals in order to examine the effect of fine crystals on the formation of RAF. On seed A, which has originally smooth surface, the smooth surface remained even after 30 to 420 seconds of growth, except for the appearance of macrosteps and a few fines. RAF could not be seen at all. When we grew another seed A in the presence of suspended finecrystals, sticking of suspended fine crystals were seldom found and RAF was not seen at all. On the other hand, a seed B(commercially produced) has originally rough surface. This is probably because in industrial crystallizers, multi-crystals are suspended under vigorously agitated conditions. Surprisingly, formation of RAF was observed after only 30 seconds growth and the RAF developed in size and number with time. From the results shown above, we come to conclusion that commercially produced crystal has origins of RAF as such and the origins developed during the growth of seed crystals. Questions arise here as to why the seed B has the origins of RAF and how the origins of RAF are generated in industrial crystallizers? In order to answer to these, we observed growth behavior of multi-crystals in an agitated vessel. In the agitated vessel, most of the crystals were agglomerated, but the surface of individual agglomerated crystals was very smooth. The corner of the crystals became to be rounded by attrition and the surface gradually became rough. After long time of operation, the surface appearance of the crystal became similar to that of the commercially produced crystals. This suggests that the origins of RAF on the surface of sodium chloride crystals are produced by attrition events caused by agitation in industrial crystallizers.