GROWTH BEHAVIOR AND KINETICS OF SINGLE AND POLY-CRYSTALS OF SODIUM CHLORIDE

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Summary

In our previous paper on the same subject it was reported that the growth rates varied substantially by the presence or absence of micro crystals in the supersaturated solutions from which single crystalline particles of sodium chloride were grown, the extent of the growth enhancement by the micro crystals was about twice in terms of the average growth rate over one hour or about 20 in the initial growth periods. In order to investigate the cause and the mechanism for the phenomena, changes in growth kinetics are measured by changing the conditions of generation of such micro crystals. In addition to NaCl crystals, growth of m-chloronitrobenzene (m-CNB) crystals from acetone solutions was also observed and analyzed for the purpose of comparison.

For the sodium chloride-water system, micro crystals were generated either by primary nucleation, secondary nucleation or addition of ground powder of NaCl crystals. The micro crystals by primary nucleation were most effective in growth enhancement, followed by secondary nuclei generated by the added commercial table salt and the ground powder was least effective indicating that the smaller nuclei are more efficient in enhancing the growth kinetics probably because they work as macro growth units during crystal growth. The ground powder has a relatively large surface areas which consume the supersaturation of the solution when each crystal grows, and it might be weaker in generating secondary nuclei than the commercial table salt crystals. From the experiments the macro growth units of which size may range from tens of nm and sub-microns are expected to play an important role in crystal growth of sodium chloride.

M-CNB crystals grew having well defined faces and showed stable growth without primary nucleation. This enabled experiments of crystal growth to see the real effects of micro crystals such that the addition of fine ground crystals to the solution from which a crystal particle is growing steadily. The addition caused sudden increase in the growth rate, thus the contribution of micro crystals was made clear. The micro crystals in this case was the secondary nuclei induced by the ground powder not the ground powder itself, which was observed on the monitor screen.

Consequently the growth of crystals from supersaturated solutions is found to be enhanced by the macro growth units present in the solution. This conclusion may lead the necessity of reconsidering growth kinetics experimentally and theoretically