07.1–11 INFLUENCE OF GROWTH CONDITIONS ON THE MORPHOLOGY OF POTASSIUM BICHROMATE CRYSTALS.

By M. Szurgot, K. Sangwal and J. Karniewicz,
Institute of Physics, Technical University of Łódź, Wólczańska 219, 93 005 Łódź, Poland.

It is well known that triclinic potassium bichromate (KBC) crystals growing from aqueous solutions assume symmetric as well as asymmetric habits. However, until now no systematic study of the growth habit of KBC in relation to relative supersaturation and growth temperature has been conducted. In this work, influence of supersaturation and temperature on anisotropy in growth along different directions, number of faces in growth habit and on surface micromorphology is investigated. Growth temperature was 10 - 90°C.

Below ca 40°C at low supersaturations, the crystals are asymmetric and show a significant anisotropy in growth along <100> and <001> directions. For these directions, there is also a pronounced anisotropy in growth rates of parallel opposite faces (polarity). However, with an increase in supersaturation, the crystals have a tendency to become symmetric and show a decrease in polarity. The total number of faces and the ratio $(a+\bar{a})/(b+\bar{b})$ and $(c+\bar{c})/(b+\bar{b})$ (where a, $\bar{a}$, b, etc., denote the growth rate along these directions) depend on temperature. The number of faces does not depend on supersaturation but the ratios do. The linear growth rate of the faces changes in the order: $(00\bar{1}) < (001)$, $(100) < (\bar{1}00)$ and $(010) \approx (0\bar{1}0)$. At higher temperatures, the character of polarity in relation to supersaturation remains the same with a mere difference in the ratio of growth rates. Asymmetric crystals were obtained even at temperatures > 50°C at lower supersaturations, implying that suppression in polarity and symmetric morphology can be achieved by an increase in supersaturation as well as temperature.

The total number of crystal faces was found to depend on temperature. It is smaller (6 - 18) for low temperature (<40°C) crystals, while it is higher and practically constant at 24 - 28 for high temperature (> 45°C) crystals. Diagonal (i.e. {111} and {110}) faces appearing in the morphology are responsible for a change in the number of faces. These faces are poorly developed on low temperature crystals with their number ranging between 1 and 4, but on high temperature crystals their number is up to 12.

The micromorphology was also observed to depend on supersaturation and temperature. At low supersaturations, the crystal faces are relatively smooth, which exhibit thick layers with increasing supersaturation. The parallel opposite polar faces show a difference in thickness and separation of visible growth layers. The slow growing faces have thicker and distantly-spaced layers. An increase in temperature leads to the appearance of thinner layers. A significant change in the shape of macrospirals was noted on {001} faces. For example at 25 - 30°C, on (001) face the angle of intersection between layers moving along [010] and [100], and along [010] and $[\bar{1}00]$ decreases to 35° from 150° with an increase in supersaturation. A similar trend was found for microspirals on $(00\bar{1})$ face.

07.1–12 SIMULATION AND RESULTS OF A SPACELAB GROWTH EXPERIMENT . GROWTH AND CHARACTERIZATION OF BRUSHITE AND LEAD MONETITE .

By M.C. Robert, F. Lefaucheux and A. Authier
Laboratoire de Minéralogie Cristallographie, associé au CNRS, Université P et M Curie PARIS FRANCE

Monocrystals of materials which have a low solubility are difficult to elaborate by conventional solution growth techniques . This is because parasitic nucleations easily appear at supersaturation jumps such as those induced by convections . When there is no alternative to solution techniques, for example for materials which have a low thermal stability, growth procedures based on diffusion controlled mass transfer are needed . This can be achieved either on earth by trapping the growth solution in a gel structure or in space by reducing the gravity under the level for which convections are no more induced in the growth solution. Both types of experiments have been performed for growth of $CaHPO_4,2H_2O$ (Brushite) and $PbHPO_4$ (Lead Monetite) . The crystalline quality of as grown crystals have been examined by X ray topography .

For the gel experiments, increasing amounts (2-10% vol) of tetramethoxysilane (TMS) have been added to a series of growth solutions ; For the space experiments, crystallisation reactors have been integrated in the First Spacelab Mission .

The crystals grown in gel are rather good except for some gel inclusions trapped mainly at the beginning of growth . Therefore, the central part is all the more contaminated that the gel is rigid . The quality can be improved by reducing the TMS content . However it is not possible to decrease this content under the limit for which the solution does not gelify .

The crystals grown from free solutions in a microgravity environment present features similar to those observed for the best gel grown crystals but without contamination For example, the position of the nucleus is only visible through the starting point of growth sector boundaries . Main growth defects in these crystals are related to the reentry in the atmosphere because growth continues for a certain time after closing the compartments containing the reactants .

These results clearly demonstrate that :

-Gel growth constitutes a good approach to prepare space experiments . Gel experiments are good substitutes if high purity materials are not requested .

-In cases where no gel systems are compatible with the wanted material, a space experiment presents a unique opportunity to get monocrystals .