Editorial Note

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Editorial Note on Solid State Chemistry

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Solid-state chemistry referred as materials chemistry which is the study of the synthesis, structure, and properties of solid phase materials, particularly, but not necessarily exclusively of, non-molecular solids. It therefore has a strong overlap with solid-state physics, crystallography, mineralogy, ceramics, thermodynamics, metallurgy, materials science and electronics with a focus on the synthesis of novel materials and their characterisation. Solids can be classified as crystalline or amorphous on basis of the nature of order present in the arrangement of their constituent particles.

Solid state chemistry encompasses the intrinsic property of materials as related to both chemical composition and structure. We hope in this volume to in particular illustrate the close links of this sub-discipline to materials chemistry rather than taking an introverted view. The area is topical as awareness of the limited availability of our natural resources grows, leading scientists to search for materials with properties that can be exploited; perhaps most notably in the generation or storage of energy. An understanding of a material allows us to optimize natural resources thereby contributing to innovation in sustainability. Current interest in solid state materials offers the promise of new materials with tuneable properties and applications as diverse as energy storage, catalysis, electronics, sensors, and separation technology. Given the diversity of solid state compounds equally diverse arrays of methods which are used for their preparation.

Oven techniques

For thermally robust materials, high temperature methods are often employed. For example, bulk solids are prepared using tube furnaces, which allow reactions to be conducted up to 1100°C. Special equipment e.g. ovens consisting of a tantalum tube through which an electric current is passed which can be used for even higher temperatures up to 2000°C. Such high temperatures are at times required to induce diffusion of the reactants. Tube furnace being used during the synthesis of aluminium chloride

Melt methods

One method often employed is to melt the reactants together and then later anneal the solidified melt. If volatile reactants are involved, then reactants are often put in an ampoule that is evacuated of the mixture

By keeping the bottom of the ampoule in liquid nitrogen, and then sealed. The sealed ampoule is then put in an oven and given a certain heat treatment. In the presence of the molten flux, certain grain will grow rapidly within a matrix of finer crystallites. This produces abnormal grain growth (AGG), which may be desired or detrimental to the produced solid.

Solution methods

It is possible to use solvents to prepare solids by precipitation or by evaporation. At times the solvent is used as a hydrothermal that is under pressure at temperatures higher than the normal boiling point. A variation on this theme which is the use of flux methods, where a salt of relatively low melting point is added to the mixture to act as a high temperature solvent in which the desired reaction can take place. This can be very useful.