Flux growth of (Oxy)nitride and Oxysulfide Crystals in an Ammonia Atmosphere

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Under Japanese national project, we have developed "Shindai crystals", which are grown by our individual technology in Shinshu university (abbreviated as "Shindai"), Japan. The "Shindai crystals" are high crystalline materials. One of typical examples of "Shindai crystals" is layered titanate crystals "NaTiO" that can remove heavy metal ions in water. These crystals have already been incorporated into various products, including household water purifiers, and are being promoted for use in domestic and overseas markets.

The "Shindai crystals" are grown by the flux method. The flux method is one of liquid-phase crystal growth technique. This method uses molten salt as solvent at high temperature to dissolve solute. As a result, various inorganics can be crystallized at lower temperature than using melting method. Utilizing recrystallization from solution, the flux grown crystals exhibit advantages, including development of crystal faces, low generation of lattice defects, thermal distortions, and crystal-size control between submicron and centimeter order. We have improved the flux-method technology individually for material science over 40 years of research. As a result, not only single crystals but also crystalline thin films, and homo-/hetero-epitaxial films can be achieved by our technique. As these crystallographic properties and related crystal designs correlate to material performances, our flux-grown crystals bring out excellent material performance, such as batteries, ion exchangers, thermal conductors, and so on. Recently, we have also focused on growing non-oxide crystals by flux method. By controlling the gas atmosphere and pressure, it is possible to spread material space beyond oxide species.

In this presentation, we introduce our recent study about crystal growth of (oxy)nitride and (oxy)sulfide materials using the flux method. They are photocatalytic materials that respond to visible light. Thus, we aim to decompose water into hydrogen and oxygen under sunlight at high efficiency. Actually, large development of photocatalytic performance has been already achieved by the flux method. Our "Shindai crystal" should be one of solution to realize a hydrogen society and a zero-carbon society.

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