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In Situ PXRD Studies of the Solvothermal Syntheses of WO₃-Ethylenediamine Hybrid Nanowires and Bi₂Se_xTe_{3-x} Nanoplatelets

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Solvothermal syntheses are very versatile for fabricating nanostructured materials. While the majority of studies focus on materials syntheses, little attention has been paid to understanding the synthesis mechanisms, which are of vital importance to the rational design of synthesis for preparing optimized materials. In this context, in situ powder X-ray diffraction (PXRD) is ideal to study solvothermal materials syntheses as it is capable of providing direct reaction information under the harsh autoclave synthesis conditions. In this presentation, I will show the application of in situ PXRD in solving the mechanisms of the solvothermal synthesis of (1) WO3-ethylenediamine inorganic-organic hybrid nanowires, and (2) Bi2SexTe3-x nanoplatelets. The WO3-ethylenediamine nanowires showed excellent performance in catalysis and water treatment and Bi2SexTe3-x nanoplatelets are topological insulators that have potential applications in the electronic and optoelectronics areas. In the in situ PXRD experiments, solvothermal syntheses were conducted in quartz glass microreactors that were placed at the beam centre of the Australian Synchrotron powder diffraction beamline, and the time resolved PXRD patterns were recorded to follow the phase evolution during the synthesis. For both materials, in situ PXRD discovered intermediate phases that played an important role in controlling the formation of the final nanostructured materials.

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In situ PXRD, solvothermal synthesis, nanowires, nanoplatelets

Summary

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