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Crystal growth of 2D-layered semiconductors, MoS₂ and GaSe for the development of novel photonic and electronic devices

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We focus on crystal growth and evaluation of 2D-layered compounds. For crystal growth, liquid phase growth with temperature difference method under controlled vapour pressure (TDM-CVP) has been studied GaSe and InSe are grown by this method. GaSe can generate wide frequency tunable terahertz (THz) wave. Due to the superior characteristic features of THz wave of high transparency like radio wave for non-polarized substances and high reflectivity to metal as light wave, THz wave can be applied for wide variety of non-destructive and non-invasive inspection. For example, disconnections and corrosion of electric wires covered with opaque insulating shield, water content in concrete, degradation of polyethelene can be measured non-destructively by using THz wave.

Futher more, we proposed a novel friction induced growth method for 2D layered thin films. MoS₂ can be grown by this method. MoS₂ is one of the promising semiconductor materials of 2D transition metal dichalcogenide which exhibits expected high electron mobility for the application of the high speed field effect transistors with low power dissipation. MoS₂ also has much attention for spintronics research field. Therefore, a novel crystal growth and synthesis methods are urgently required at present.

In addition with the conventional photoluminescence, Raman spectroscopy and XRD. we have developed a new evaluation method for the determination of Van der Waals bonding force between layers. Van der Waals bonding energy has been directly measured for the first time since the famous London's theoretical analysis in 1937 In this research, successful synthesis of 2D layered materials are shown with those optical, electrical and Van der Waals bonding force characterizations.

Biography

Takafumi Ito is graduate student at Tohoku university. His major is material and science. He has been learning many kinds of material such as metal, semiconductor, ceramics and so on at college and graduate school. He studies and researches semiconductor at the university now.

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