九州大学超顕微解析研究センター
微細構造解析プラットフォーム「ナノマテリアル開発のための超顕微解析共用拠点」

第 227 回ＨＶＥＭ研究会
のお知らせ

令和元年 12 月 5 日

インド工科大学マンディー校より Aditi Halder 准教授 と Viswanath Balakrishnan 准教授をお招きし、下記のご講演をいただきます。皆様、奮ってご参加ください。

【日　　時】令和元年 12 月 25 日（水）　13 時 30 分 ～ 15 時 30 分

【会　　場】九州大学　鉄鋼リサーチセンター（EN40 棟）　２階　セミナー室
（〒819-0395　福岡県福岡市西区元岡 744）

【講 演 １】 Viswanath Balakrishnan 氏
インド工科大学マンディー校
工学部准教授
"Stabilizing unstable phases in 2D materials and heterostructures"

【講 演 ２】 Aditi Halder 氏
インド工科大学マンディー校
理学部准教授
"Materials for Hydrogen Evolution Using Earth-abundant Elements"

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交通手段の詳細や当研究会についてのお問い合わせは、下記の連絡先にお願いいたします。
各講演の概要と会場へのアクセスを次ページ以降に示します。

ＨＶＥＭ研究会世話人：波多　聰・安田和弘・佐藤幸生
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Abstract

【講演１】

“Stabilizing unstable phases in 2D materials and heterostructures”

Two dimensional materials offer unique opportunities to control defects and stabilize polymorphic phases towards optoelectronic and energy applications to great extent. Growth of 2D materials with ability to control the co-existing polymorph assembly in single domain provides unique platform to produce seamless homojunctions with different properties. We achieved large area of chemical vapour deposited (CVD) growth of 2D monolayer WS_2 having their two polymorphs (1H/1T or 1H/1T’) forming homojunctions in single domain. We have identified CVD grown homojunctions with different phases of WS_2 monolayers using detailed microscopic as well spectroscopic techniques. Formation of in-plane heterostructures with 1H and 1T’ polymorphs have been extensively analysed using variety of spectroscopic as well as microscopic techniques, along with the lifetime luminescence imaging. Atomic resolution scanning transmission electron microscope have been used to identify the lateral glided S-column in hexagonal WS_2 arrangement, causing intrinsic lattice distortion dominated polymorphic phase (1H, 1T’ and 1T) formation. In situ Raman spectroscope and microscope observations reveal that the formation of heterophases in WS_2 cancel competing thermal mismatch and lattice strains and stabilize crack free monolayer heterostrutures while homophase WS_2 monolayer suffers from severe cracking. Further we investigated the evolution of point defects induced void formation during the growth and their role on crack propagation in WS_2 monolayer. Owing to other interesting properties of metastable 1T phase, we also investigated *in- situ* phase transition characteristics and developed strategies to stabilize 1T phase in WS_2 monolayer. The formation and stability of in plane heterostructures involving polymorphic phases and heteroatomic interfaces have been explored. The investigated 2D materials and their heterostructures show interesting optical, electrical and energy storage properties.

【講演２】

“Materials for Hydrogen Evolution Using Earth-abundant Elements”

The state-of the art catalyst for polymer-electrolyte-membrane fuel cell and electrolyzer suffers the problems associated with higher cost and durability. The less expensive first row transition metals based oxides are found to be the suitable alternatives. Water electrolysis is one of the effective strategies to produce hydrogen with the help of an efficient electrocatalyst. Nickel, tungsten and molybdenum are few of the transition metals and their oxides which found to be very efficient on electrochemical hydrogen production. In the first part of the presentation, we will show how the incorporation of oxygen vacancies or oxygen doping in transition metal oxides (TMOs) and sulphides are found to be very beneficial for the production of hydrogen.

In the second part of the work, we will show our work on single atom catalysts (SAC) which is a new kind of material which has emerged as newer alternative with the view “ATOM ECONMOY”. SACs are basically isolated metal atoms dispersed on solid supports, ideally having on spatial ordering or any other types of notable interaction among the other isolated individual atoms. A suitable support material strongly anchors the metal species -preventing them to aggregate and creating stable, finely dispersed metal clusters with a high catalytic activity. In our group we are aiming to design low cost SACs or pseudo-SAC materials made of transition metal and metal oxides for energy conversion.

九州大学へのアクセスマップ。会場は伊都キャンパスにあります。

伊都キャンパスマップ（本学 HP より引用。一部のみ掲載）。会場は㉔です。