別紙

学術変革領域研究（A）の公募研究の内容（英語版）

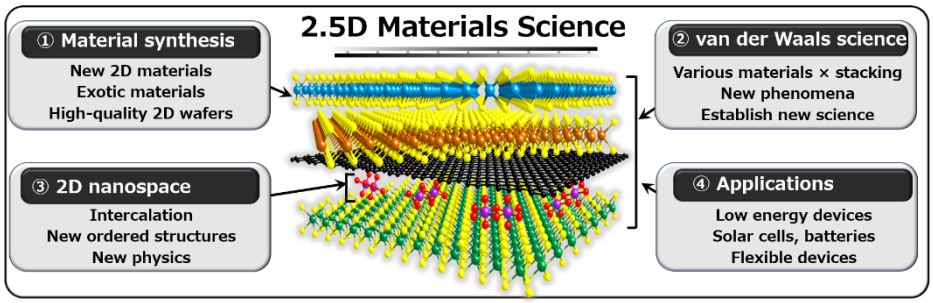
Science of 2.5 Dimensional Materials: Paradigm Shift of Materials Science Toward Future Social Innovation
http://25d-materials.jp

Number of Research Area	:	21A206	Term of Project :	FY2021-2025
Head Investigator	:	AGO Hiroki		
Research Institution	:	Kyushu University, Global Innovation Center (GIC)		

1. Details of Research Area

Materials science has established the basis of our modern society through the development of emergent internet of things (IoT) technologies. Traditional materials science is mainly based on the precise control of bulk materials with rigid chemical bonds. On the other hand, two-dimensional (2D) materials, such as graphene, offer innovative approaches to create new materials by integrating different layers via van der Waals interaction. This is accomplished by stacking 2D materials with controlled compositions and stacking angles, an approach that is expected to significantly expand the frontiers of materials science. Furthermore, the well-defined 2D nanospace between the layers of stacked 2D materials provides opportunities to explore novel physical and chemical phenomena and to synthesize new materials.

In this Research Area we propose to explore the "Science of 2.5 dimensional materials" by introducing the concepts of "freedom of integration" and "2D nanospace", in combination with the synthesis of a wide variety of 2D materials. We aim to develop academic research based on this unique "2.5D" concept to achieve world-leading results, giving rise to upcoming future social innovation. This Research Area consists of five Research Groups (A01~A05), and all the members in this area collaborate closely to establish the new scientific field. In addition, the collaborations are supported by the joint research centers organized in this Area, allowing access to a wide range of facilities, such as automatic stacking equipment, to all the members.



2. Call for Proposals and Expectations for Publicly Offered Research, etc.

In this Research Area, we are developing unique and novel 2.5D material research by integrating the strength of each member through extensive collaboration. Therefore, researchers applying to this Publicly Offered Research are strongly encouraged to provide a detailed plan of collaboration with some of our group members in addition to an original research plan. Applicants also should show how their proposed research can contribute to this Research Area.

Here, "0.5D" symbolizes the new degrees of freedom offered by 2D materials including material stacking, 2D nanospace science, and the integration of 2D materials with 0D, 1D, and 3D materials into mixed-dimensional heterostructures. Emergence of new materials, physical properties, and applications are expected through the introduction of this "0.5D" concepts in 2D materials research. The followings are the details of the intended candidates:

(1) Researchers studying 2D material and planning to develop 2.5D research through extensive collaborations
(2) Researchers who have not worked with 2D materials, but want to start 2.5D research based on their original concepts and techniques
(3) Researchers with specialized analysis techniques which are applicable to 2.5D materials
(4) Researchers studying theoretical physics and materials informatics that can form the basis of 2.5D research
(5) Researchers studying semiconductor devices, energy creation/storage, or areas that contribute to social innovation
(6) Young researchers and female researchers

3. Research Group, Upper Limit of Annual Budget and Number of research projects scheduled to be selected

Research Group Number	Research Group	Upper Limit of Annual Budget (Million yen)	Number of research projects scheduled to be selected
A01	Materials synthesis for 2.5D structures	Experimental: 5 Experimental or theoretical: 3	4 15
A02	Assembly for 2.5D integrated structures		
A03	Development of analysis methods for 2.5D structures		
A04	Development of novel physical properties with 2.5D structures		
A05	Development of electronic, photonic, and energy applications with 2.5D structures		