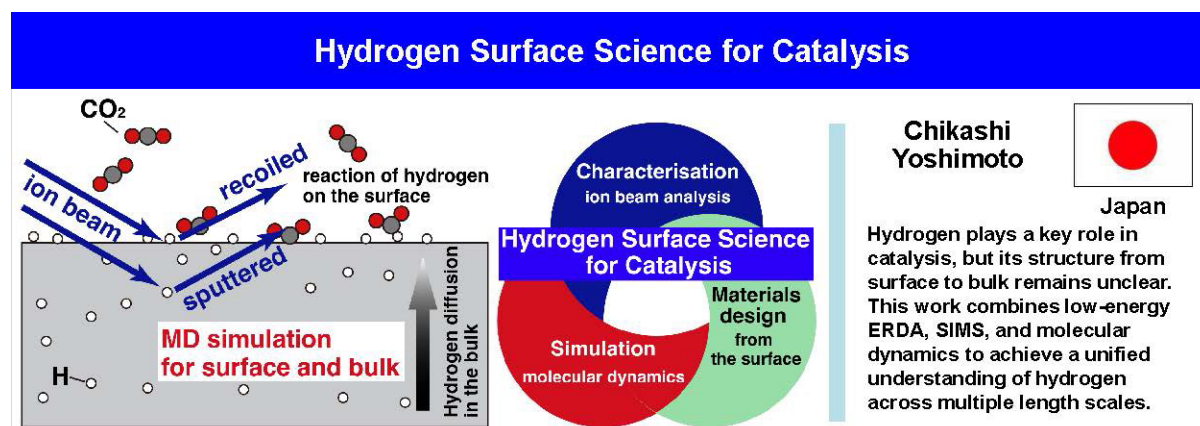


<Research Topics>

Hydrogen Surface Science for Catalysis

ICYS Research Fellow Dr. Chikashi YOSHIMOTO



■ Research

The realization of carbon neutrality requires a deeper understanding of surface reactions that govern catalytic processes such as CO₂ utilization. In particular, hydrogen plays a key role, as its chemical state (it can exist in both protonic and hydridic states, i.e., H⁺/H⁻) strongly influences reaction pathways and product selectivity. However, experimental determination of hydrogen speciation at material surfaces remains limited. The aim of this research is to clarify the speciation and structural configuration of hydrogen at the material surface. Low-energy ERDA is employed to directly probe hydrogen at the outermost surface, while SIMS and molecular dynamics simulations provide complementary insights into hydrogen behaviour from surface to bulk. By integrating ion beam analysis and atomistic simulations, this study establishes a unified understanding of hydrogen from surface to bulk, providing a basis for materials design from the surface.

■ Comments

I am delighted to conduct my research in the outstanding environment provided by ICYS. The program offers a valuable opportunity to pursue independent and ambitious research with access to advanced facilities at the National Institute for Materials Science.

My research background is in Earth and planetary sciences, where I have investigated hydrogen in natural materials. At ICYS, I aim to build on this perspective by incorporating advanced materials science approaches, focusing on hydrogen at material surfaces through ion beam analysis and atomistic simulations. This allows me to connect knowledge of hydrogen in natural systems with state-of-the-art techniques developed in materials science.

The interdisciplinary environment at ICYS, with researchers from diverse fields, provides a stimulating platform for exchanging ideas and developing new collaborations.

■ Link

<https://www.nims.go.jp/icys/research/#YOSHIMOTO>