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| Name<br>YAMADA Hirotoshi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Job Title<br>Associate Professor | Area of Expertise<br>Solid State Electrochemistry |
| <p><b>1. Main Research Topics</b></p> <p><b>Development of all-solid-state batteries (ASSBs)</b></p> <p>To practically realize all-solid-state batteries (ASSBs), which are the candidates of next-generation batteries, our group focuses on materials, processes, and designs of ASSBs. We have developed technologies to fabricate bulk-type ASSBs using oxide-based solid electrolytes and demonstrated that the ASSBs can be operated at room temperature. We further study the multiscale phenomena in the range from atoms/ions to whole ASSBs, in order to improve the battery performances like power density and cycle-ability, etc.</p> <div> </div> <p>Figure Phenomena and their scales on the development of ASSBs.</p> <p><b><u>1. Preparation of electrochemically active interface between active materials and solid electrolytes.</u></b></p> <p>We develop methods to fabricate interfaces between active materials and solid electrolytes, which consists of different elements in each phase. Such interfaces must be densely packed without element interdiffusion. We carry out fundamental studies on the phenomena at the interfaces, which leads designs ideal electrode architectures and processes. The materials, architecture, and processes are simultaneously optimized.</p> <p>Ad ditionally, we also focuses on mechanical properties of ASSBs, because the ASSBs contain internal stresses and strain caused by the fabrication and battery operation. Such strain induces fracture of interfaces in the ASSBs, which causes deterioration of battery capacity. We investigate the strain and the fracture of interfaces buried inside the ASSBs and improve cycle- ability of ASSBs.</p> <p><b><u>2. Development of all-solid-state lithium metal batteries.</u></b></p> <p>Lithium metal is known as ultimate anode because of its low electrode potential and large capacity. However, it is very difficult to reversibly charge/discharge lithium metal anode. We investigate causes of the difficulty and develop lithium metal anodes with high capacity, high power and high cycle-ability.</p> <p><b><u>3. Study of influence of local structure of solid electrolytes on their ionic conduction.</u></b></p> <p>Highly conductive solid electrolytes are necessary to fabricate practical ASSBs. We investigate influence of the local structure of solid electrolyte crystals on their ionic conduction and develop new solid electrolytes.</p> |                                  |                                                   |
| <p><b>2. Keywords</b></p> <p>All-solid-state batteries, solid electrolytes, interface</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                                                   |
| <p><b>3. Remarks and Websites</b></p> <p>We carry out whole studies on oxide-based ASSBs from the viewpoint of materials, processes, and architectures. The fields of the studies are widely spread in the multi-discipline sciences not only on solid state chemistry and electrochemistry but also analytical chemistry and material mechanics.</p> <p><b>researchmap:</b> <a href="https://researchmap.jp/0000-0003-0733-6992">https://researchmap.jp/0000-0003-0733-6992</a><br/> <b>Group website:</b> <a href="https://www.cms.nagasaki-u.ac.jp/lab/bukka/B/">https://www.cms.nagasaki-u.ac.jp/lab/bukka/B/</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                                                   |