Preface

Hydrogen is the most abundant atom in the universe. It exists in various states, namely, neutral atom (H^0), covalent bonding atom (H^{cov}), proton (H^+), and hydride (H^-), depending on the circumstance. Furthermore, hydrogen is the smallest/lightest atom, and its isotope effect is significant. Owing to these interesting properties, hydrogen has attracted enormous attention by many physicists and chemists for a long time. In physics, research on hydrogen can be classified into two categories: one is behavior of hydrogen itself, such as in hydrogen-bonded systems and metal hydrides, and the other is roles of hydrogen in materials (hydrogen drastically changes their electronic states, for example, in semiconductor hydrides and superconducting solids). Recently, sulfur hydride under high pressure broke a world record of super conducting temperature. In material science, research on hydrogen has many branches, such as hydrogen storage and conducting materials for fuel cells, electronic devices using hydrogen in heterointerfaces, and catalytic reactions of active hydrogen species. From the viewpoint of research approach, experimental methods, such as neutron scattering, μSR and NMR, which are powerful in hydrogen research, have been highly sophisticated recently. Hydrogen research is now remarked also in computational science, such as ab initio calculations and molecular dynamics simulations. Moreover, it should be noted that "Hydrogenomics" project (Grant-in-Aid for Scientific Research on Innovative Areas, MEXT, Japan) is now in progress.

As described above, hydrogen science has a long history and is reaching a new peak now. In this Special Topics, 16 invited scientists working in the field of hydrogen science present review articles to show the frontier of each research field and to appeal to the readers of JPSJ about the interest in hydrogen science. We hope that this Special Topics will contribute to the further development of hydrogen science.

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