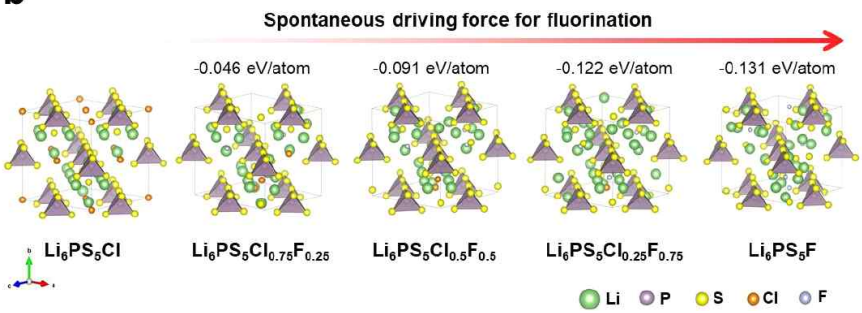
붙임2 **Research Outcomes Report**

Research Outcomes	Surface Fluorination Shielding of Sulfide Solid Electrolytes for Enhanced Electrochemical Stability in All-Solid-State Batteries
Performance Objectives	Published in a Top 10% JCR Journal
Type of Performance	☑ Research Article(Paper) ☐ Patents ☐ Researcher Exchange ☐ Researcher Engagement ☐ Information Exchange ☐ Others
Description of Performance Type	Published in ***Advanced Materials*** (JCR top 3.8%)
Research Institutes	Korea Advanced Institute of Science and Technology (KAIST) / Prof. Dong-Hwa Seo / Jae-Seung Kim et al. (14 others)
Attachments (Image, Photograph, Ect.)	**a** $2Li_6PS_5Cl\ (s) + 5F_2\ (g) \rightarrow P_2S_7\ (s) + 2LiCl\ (s) + 10LiF\ (s) + 3S\ (s)$ **b**  <Identification of spontaneous substitution mechanisms and reaction equations via computational chemistry.>
Achievement Date	2025.03.15
Summary of Performance	- Developed surface-fluorinated solid electrolytes with enhanced high-voltage stability and clarified the underlying mechanism for improved integration in all-solid-state batteries. - This approach significantly boosted battery lifespan and capacity, contributing to sustainable solid-state battery commercialization. - The results were published in ***Advanced Materials***, a top-tier journal ranked in the top 3.8% in JCR.
Description of Performance	■ **Key Features** - Exploring commercialization strategies for all-solid-state batteries through surface fluorination of sulfide solid electrolytes. ■ **Performance** - High ionic conductivity of 2.1 x 10^{-5} S cm^{-1} was achieved among fluorinated compounds through a surface fluorination strategy. - In cells utilizing NCM cathodes, 90.4% of the initial capacity was retained after 50 cycles. - Under commercial-level loading conditions (0.33C), a pouch cell exhibited 69.4% capacity retention after 200 cycles. ■ **Excellence of the Results** - Oxidation stability of the argyrodite-type solid electrolyte Li_6PS_5Cl, considered a promising material for all-solid-state battery commercialization, was improved through a surface fluorination strategy. - Commercialization potential was validated through the application of pouch cells capable of large-area fabrication. ■ **Uniqueness of the Results** -Proposed a sustainable battery strategy via gas-phase reactions without additional synthesis steps. -Formed a surface-to-bulk fluorinated structure without additives or high-temperature sintering.