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Electride : Materials and Applications

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We have studied electronic functionality in wide gap oxide-based materials over 20 year aiming at cultivation of new frontier in which fundamentals and applications. The representative achievements are material designing of transparent amorphous oxide semiconductors such as IGZO and their TFT applications, which are now widely used to drive flat panel displays [1], and discovery of high-Tc iron-based superconductor [2], which has grown to a new continent comparable to cuprate superconductors discovered in 1986.
In this talk, I focus on progress of electride materials (in which electrons serve as anions) and their application, placing emphasis on catalyst for green ammonia synthesis [3]. Fig.1 shows the materials and applications of electrides we reported. Excellent catalysts are demanded for for green ammonia synthesis using H_2 produced from water electrolysis. Electrides have low work function arising from nucleus-free anionic nature and work well for activation of N_2. Progress in the electride catalysts are summarized in Fig.2.

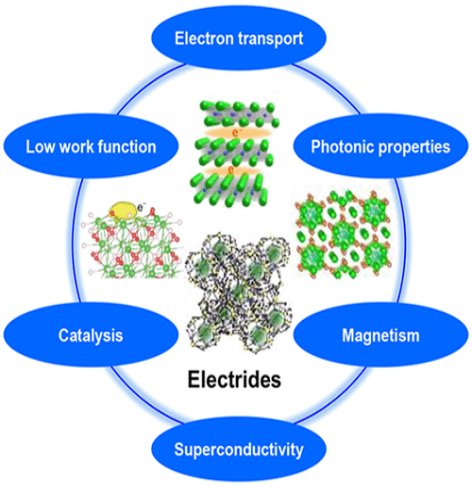


Fig.1. Materials and applications of electride

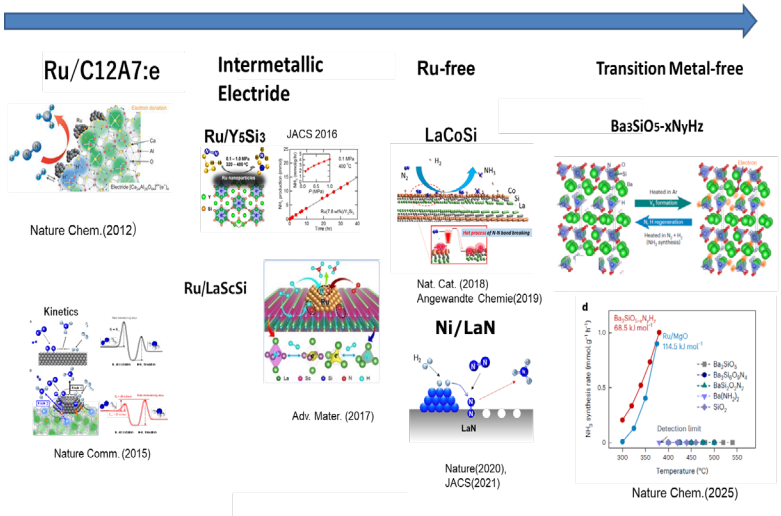


Fig.2 Progress in electride catalysts

[1] HOSONO, Hideo; KUMOMI, Hideya (ed.). Amorphous Oxide Semiconductors: IGZO and Related Materials for Display and Memory. John Wiley & Sons, 2022.
[2] HOSONO, Hideo, et al. Recent advances in iron-based superconductors toward applications. Materials today, 2018, 21.3: 278-302.
[3] Hosono, H., & Kitano, M. (2021). Advances in materials and applications of inorganic electrides. Chemical Reviews, 121(5), 3121-3185.