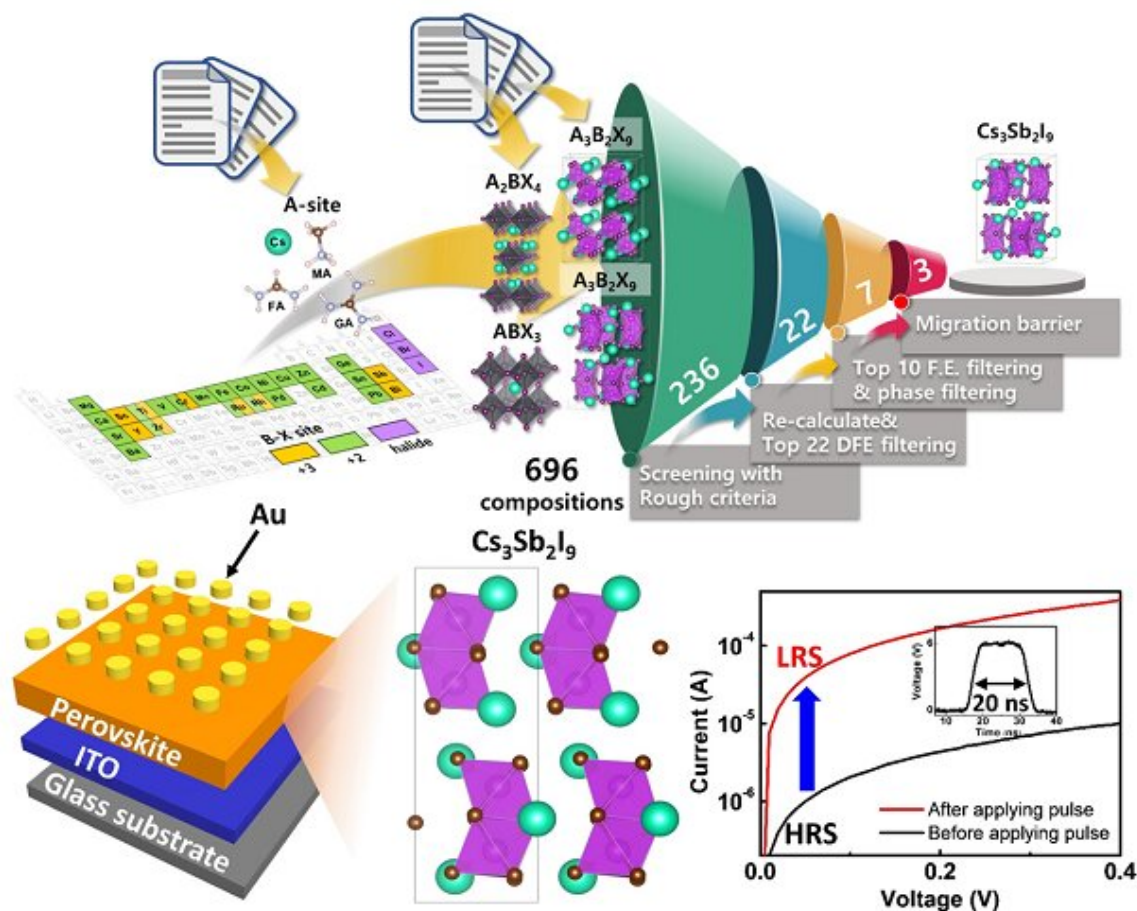


# Perovskite memory devices with ultra-fast switching speed

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The strategy to design the halide perovskite for the ultra-fast switching memory by combining first-principles calculations and experimental verification.

Credit: Pohang University of Science & Technology (POSTECH)

A research team led by Professor Jang-Sik Lee of Pohang University of Science and Technology (POSTECH) has successfully developed the halide perovskite-based memory with ultra-fast switching speed. The findings from this study were published in *Nature Communications* on June 10, 2021.

Resistive switching memory is a promising contender for next-generation memory [device](#) due to its advantages of simple structure and [low power consumption](#). Various materials have been previously studied for resistive switching memory. Among them, [halide](#) perovskites are receiving much attention for use in the memory because of low operation voltage and high on/off ratio. However, halide perovskite-based memory devices have limitations of slow switching speed which hinder their practical application in memory devices.

To this end, the researchers at POSTECH (Prof. Jang-Sik Lee, Prof. Donghwa Lee, Youngjun Park, and Seong Hun Kim) have successfully developed ultra-fast switching memory devices using halide perovskites by using a combined method of first-principles calculations and experimental verification. From a total of 696 compounds of halide perovskites candidates,  $\text{Cs}_3\text{Sb}_2\text{I}_9$  with a dimer structure was selected as the best candidate for memory application. To verify the calculation results, memory devices using the dimer-structured  $\text{Cs}_3\text{Sb}_2\text{I}_9$  were fabricated. They were then operated with an ultra-fast switching speed of 20 ns, which was more than 100 times faster than the [memory devices](#) that used the layer-structured  $\text{Cs}_3\text{Sb}_2\text{I}_9$ . In addition, many of the perovskites contain lead (Pb) in the materials which has been raised as an issue. In this work, however, the use of lead-free perovskite eliminates such environmental problems.

"This study provides an important step toward the development of resistive switching memory that can be operated at an ultra-fast switching speed," remarked Professor Lee on the significance of the

research. He added that "this work offers an opportunity to design new materials for [memory](#) devices based on calculations and experimental verification."

**More information:** Youngjun Park et al, Designing zero-dimensional dimer-type all-inorganic perovskites for ultra-fast switching memory, *Nature Communications* (2021). [DOI: 10.1038/s41467-021-23871-w](https://doi.org/10.1038/s41467-021-23871-w)

Provided by Pohang University of Science & Technology (POSTECH)

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