Supporting information for:
Superconductivity in an inorganic electride $12CaO\cdot7Al_2O_3:e^-$.

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Experimental section

The single-crystal electride was prepared by a reduction treatment of $12CaO\cdot7Al_2O_3$ (C12A7) single-crystal using Ti metal. The single-crystal ingot, grown by a floating zone method, was cut into ~4×15×2 mm^3 (sample A) and ~2×6×1 mm^3 (sample B) blocks. Each block was sealed in a silica glass tube with a Ti metal shot under a vacuum of ~10^{-1} Pa and then the sealed tube was heated at 1100°C for 24 h. During the heating the extra-framework oxygen ions were almost exclusively replaced with electrons as a result of reactions: Ti (surface) + xO^{2-} (cage) → TiO_x (surface) + $2xe^-$ (cage). The TiO_x layer on the surface was mechanically removed before subsequent measurements.

The electride thin films were fabricated by a reduction of a C12A7 film on $Y_3Al_5O_{12}$ (YAG) substrate through a two-step C12A7 film deposition process. First, an a-C12A7 film was deposited on a YAG(100) single-crystal substrate by a pulsed laser deposition (PLD) method at room-temperature (RT) in O_2 pressure of ~1×10^{-4} Pa, followed by a post-annealing at 1000°C in dry O_2 atmosphere for crystallization. Then, a-C12A7 layer with a thickness of ~30 nm was deposited again on the crystallized C12A7 film by the PLD. Since the deposition was performed in the reducing atmosphere, the deposited amorphous thin films are oxygen-deficient. Thus, almost all of the extra-framework oxygen ions in the crystallized film were transferred to the amorphous film during the deposition and cooling processes.

Cross-sectional structure of the films was characterized by a high-resolution transmission electron microscopy operating at 400 kV using JEM-4000EX (JEOL). Hall voltage measurements of thin film electrides were performed by a van der Pauw method at RT using an ac magnetic field Hall measurement equipment (Toyo Technica). Optical absorption spectra in a visible region were measured using a spectrophotometer (Hitachi U4000). Electrical resistivity measurements were carried out by a four-probe method in the range 2-300 K using a Physical Properties Measurement System (Quantum Design). They were extended down to 85 mK in a dilution refrigerator. An ac magnetic susceptibility was taken by recording the change in the mutual inductance between two small coils at 120 Hz with a conventional lock-in amplifier. The coil response was calibrated by measuring aluminum and titanium bulk metals with similar size and shape.

Additional data of the C12A7 electride thin films by TEM and optical measurements.

The figure S1 below shows TEM images and optical properties of (100)-oriented C12A7 electride films on YAG(100) substrate.

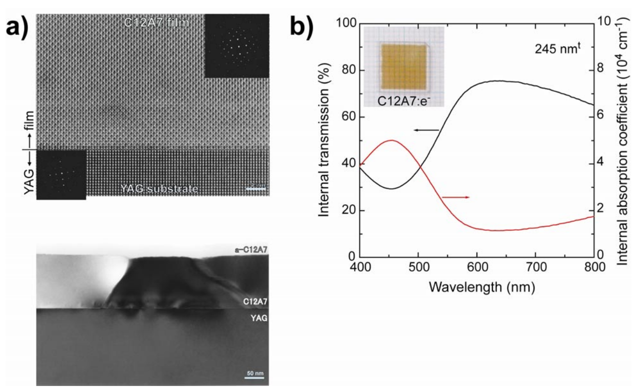

Figure S1. (**A**) Cross-sectional images of a transmission electron microscopy and electron diffraction patterns of the C12A7 electride thin film on YAG(100) substrate. (Top) high-resolution image of near the interface, and (bottom) a whole image. (**B**) Internal optical transmission and absorption coefficient spectra of C12A7 electride thin film (245-nm thickness) on YAG(100) in the visible region (400~800 nm) at room-temperature. The average internal-transmission is ~60 %. Inset shows a photo of the thin film.