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Surface of RT stable electride $C1_2A_7$:e and application to catalytic supports

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Electride is the compound in which electrons serve as anions. We reported the first RT stable electride C12A7:e using 12CaO $7Al_2O_3$ (C12A7) crystal with nanoporous structure in 2003 and it exhibits insulator-metal-superconductor transition by increasing anionic electron concentration [1]. A unique property of C12A7:e has a very small work function (2.4 eV) comparable to metal potassium but chemical and thermal stability [2]. Such a characteristic is very favorable for activation of inert molecules like N2[and CO_2 [3] First we examined the surface structure of C12A7:e using the single crystal with STM and found that although the surface prepared in UHV is insulating, an appropriate heating induced surface reconstruction retaining the bulk properties at the surface. Next, catalytic activity of C12A7:e for ammonia synthesis at mild condition by depositing Ru-nanoparticles on them [4]. The activation energy for the reaction is reduced ~1/2 and the catalytic activity (TOF) is enhanced by an order of magnitude than those of conventional Ru-catalysts reported so far [5]. Amorphous C12A7:e thin films were fabricated by sputtering. The resulting a-C12A7:e thin film is transparent and has a work function of 3.0eV. These properties meet the requirements for electron injection material in organic light emitting diodes (OLEDs). We fabricated OLEDs using a-C12A7:e as the electron layer comparing the performance with the conventionally used LiF/Al. The threshold voltage for lighting was rather reduced by use of a-C12A7:e:

[1] Review S-W.Kim and H.Hosono, Philo.Mag.92,2596-2628(2012).
[2] Y.Toda et al. Adv.Mat.19, 3564(2007).
[3] Y.Toda et al. Nat.Comm.4, 2378(2013).
[4]M.Kitano et al. Nat.Chem 4,934(2012), ; Nat. Comm.6, 6731(2015).