Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Modulation of surface plasmons coupling for optical enhancement of silver-coated alkali metal films

Kihyon Hong, Jun Ho Son, Kisoo Kim, Sungjun Kim, Illhwan Lee, and Jong-Lam Lee*

Division of Advanced Materials Science and Department of Materials Science and Engineering, Pohang University of Science and Technology (POSTECH), Pohang, Kyungbuk 790-784, Korea

RECEIVED DATE (automatically inserted by publisher); E-mail: jllee@postech.ac.kr

Supplementary information

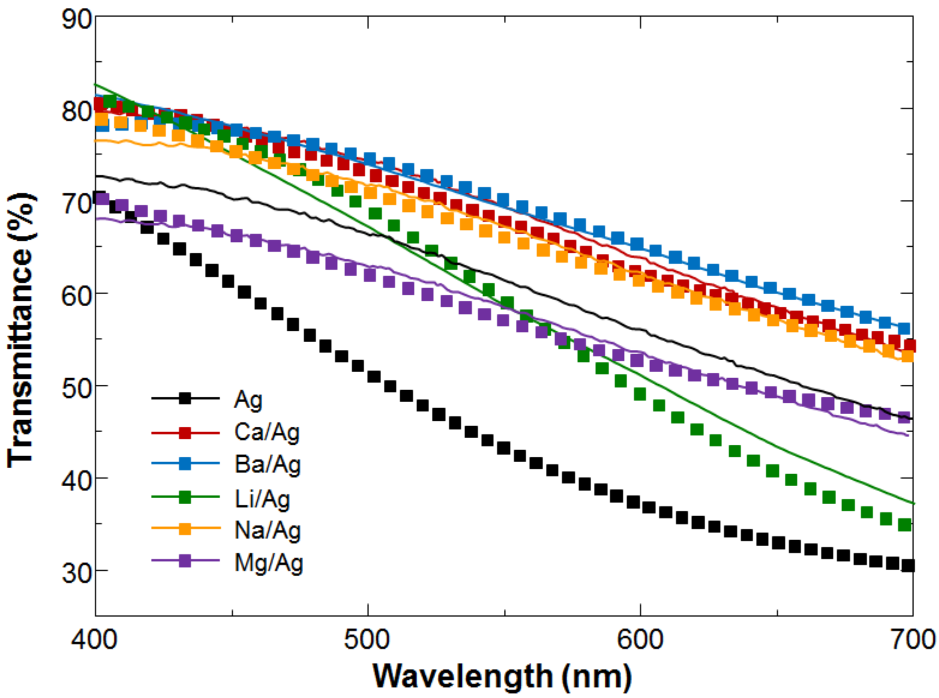

Figure S1. Calculated (lines) and measured (symbols) transmittance of 10 nm-thick Ag and alkali metal/Ag (10 nm/10 nm) samples.

Figure S1 simulated and measured transmittance of the Ag (10 nm) and various kinds of alkali metals (Ca, Ba, Li, Na, and Mg)/Ag samples as a function of wavelength. The simulation result showed a transmittance higher than 60 % for each sample. However, the measured spectra of Ag sample showed much lower transmittance (< 50 %) than that of simulated one in visible region. In the meanwhile, the simulation results agreed well with the experimental ones for the alkali metal/Ag samples.

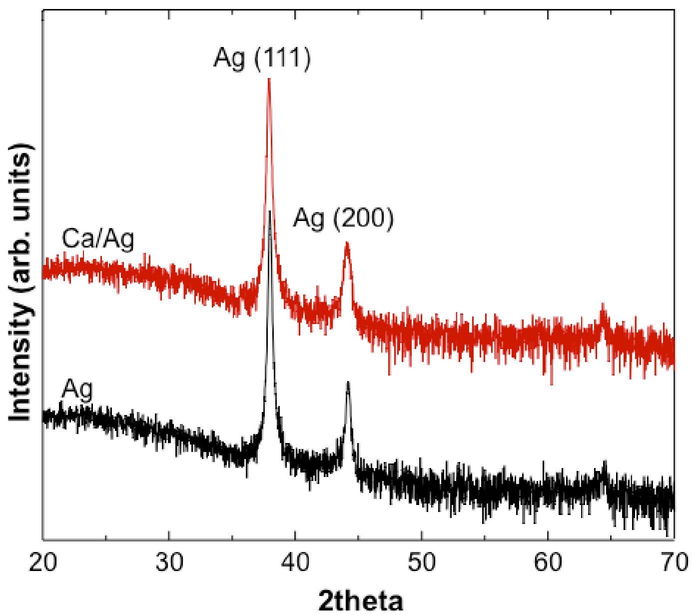

Figure S2. X-ray diffraction profiles for Ag and Ca/Ag films.

Figure S2 shows the X-ray diffraction profiles for Ag and Ca/Ag films. Because The X-ray diffraction (XRD) spectra of Ca/Ag double layer also reveal that there is no Ca-Ag intermetallic compound. Because Ca and Ag show no solubility of Ca in Ag (or Ag in Ca) up to 1300 ^{o}C under equilibrium condition, we think that these results imply that Ca-Ag (or Ag-Ca) alloy does not exist in thermally evaporated Ca/Ag double layer.

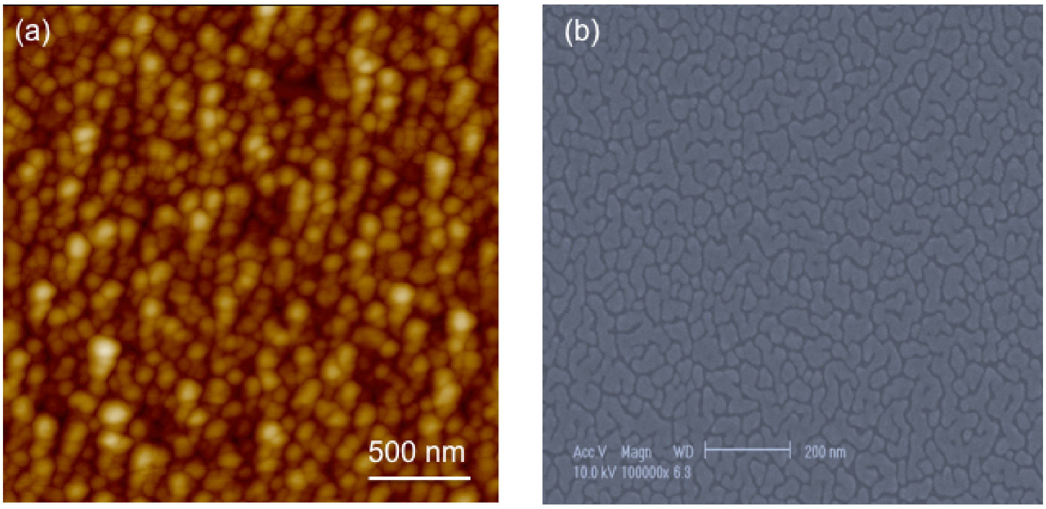

Figure S3. (a) Atomic force microscopy and (b) SEM images of 10 nm-thick Ag film deposited on LiF coated glass substrate.

Figure S3 atomic force microscopy and scanning electron microscope images of 10 nm-thick Ag film deposited on LiF coated glass substrate. Our SEM and AFM images showed that the 10 nm-thick Ag film deposited on LiF coated glass substrate has discontinuous island morphology. This discontinuous morphology induce SP coupling at the substrate/Ag interface, resulting in low transmittance value (47.9 % at λ=520 nm) of 10 nm-thick Ag film.

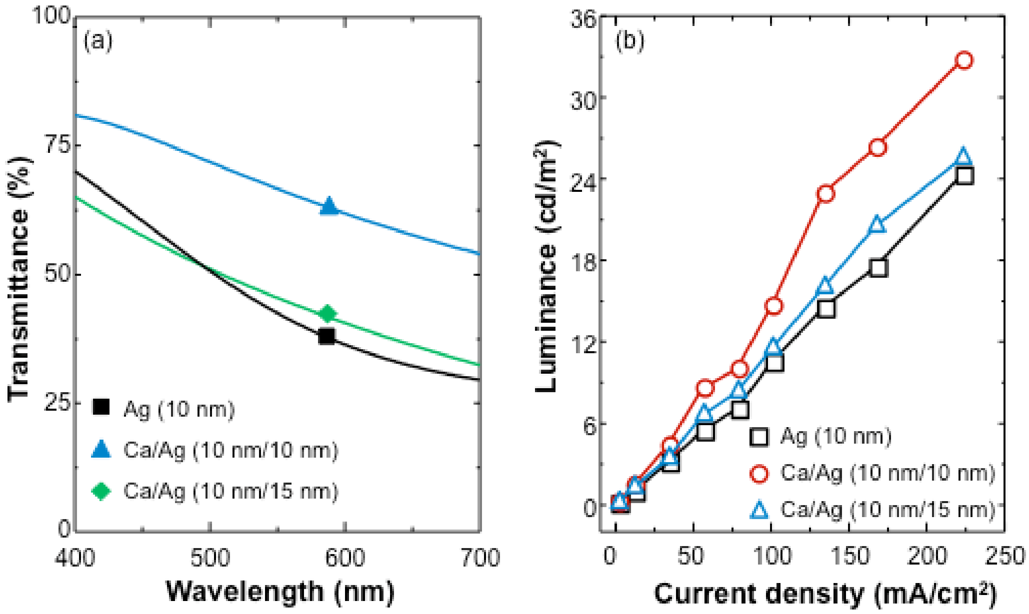

Figure S4. (a) Optical transmittance spectra of Ag (10 nm), Ca/Ag (10 nm/10 nm), and Ca/Ag (10 nm/15 nm). (b) Current density-luminance characteristics of OLEDs with different cathode structure.

Figure S4(a) revealed the optical transmittance spectra of Ag (10 nm), Ca/Ag (10 nm/10 nm), and Ca/Ag (10 nm/15 nm). As shown in Fig. R3(a), the Ca/Ag (10 nm/15 nm) and Ag (10 nm) samples showed similar transmittance value (49.1 % and 47.9 %) at 520 nm. The OLED with Ca/Ag (10 nm/15 nm) showed a slightly higher luminance value (25500 cd/m^2) than that of the device with Ag (24300 cd/m^2). When Ca/Ag (10 nm/10 nm) films employed, however, the luminance value drastically increased to 32700 cd/m^2 due to its high transmittance value (69.8 %). Thus, it is reasonable to think that increased optical transmittance of Ca/Ag is more dominant factor than enhanced electron injection efficiency for improving the luminance property of OLEDs.