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Cathode Luminescence Spectroscopy of Gold Nanoparticle Catalyst in CO and O_2 Environments TAKAYUKI TANAKA, NAOKI YAMAMOTO, KUNIO TAKAYANAGI, Tokyo Institute of Technology; CREST, JST — Gold nanoparticle catalysts for low-temperature CO oxidation ($2CO+O_2 \rightarrow 2CO_2$) [1] are especially attractive for applications in air purification. It is proposed that the resonance state of O_2 (O_2^-) activates oxidation of CO and hydrocarbon in and gold nanoparticle on TiO_2 (Au/TiO_2) [1, 2] and TiO_2 photocatalyst [3]. The TiO_2 is prepared by cleavage and annealing of rutile single crystal. Gold nanoparticles were deposited at vacuum. The Au/TiO_2 catalyst was observed by scanning transmission electron microscopy (STEM). Cathode luminescence spectra were acquired, when the electron probe were scanned in Au/TiO_2. A CL peak is detected in spectra of vacuum. The peak energy depended on specimen and its location, e.g. 3.10 and 3.15 eV. The energies were close to band gap energy (3.0 eV). The CL peak of vacuum is attributed to electron-hole recombination of TiO_2. The peak energy shifts because of interference effects. Cathode luminescence spectra change by O_2 exposure of $3x10^{-4}$ Pa. The differential spectra from vacuum to O_2 show new peaks, which have larger energies than band gap energy, 3.1 to 3.6 eV. The new peaks by O_2 exposure are the resonance state of O_2 adsorption. We will report the results of CL experiments of O_2, CO exposure and co-exposure of CO and O_2 and propose mechanism of CO oxidation in Au/TiO_2. [1] M. Haruta, et al., J. Catal. 144 (1999) 175. [2] T. Tanaka, et al., Surf. Sci. 604 (2010) L75. [3] H. Irie et al, J. Phys. Chem. C 113, 10761 (2009).

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