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Equivalent Circuit Modeling for Carbon Nanotube Schottky Barrier Modulation in Polarized Gases TOSHISHIGE YAMADA, NASA Ames Research Center — We study the carbon nanotube Schottky barrier (SB) at the metallic electrode interface in polarized gases using an equivalent circuit model. The gas-nanotube interaction is often weak and very little charge transfer is expected [1]. This is the case with oxygen, but the gas- electrode interaction is appreciable and makes the oxygen molecules negatively charged. In the closed circuit condition, screening positive charges appear in the nanotube as well as in the electrode, and the SB is modulated due to the resultant electrostatic effects [2]. In the case of ammonia, both the gas-nanotube and gas-electrode interactions are weak, but the SB can still be modulated since the molecules are polarized and align in the preferred orientation within the gap between the electrode and nanotube in the open circuit condition (dipole layer formation). In the closed circuit condition, an electric field appears in the gap and strengthens or weakens the preferred dipole alignment reflecting the nanotube Fermi level. The resultant dipole field modulates the SB. The modulation is visible when the nanotube depletion mode is involved, and the required dipole density is as low as 2 x 10 ^{13} dipoles/cm^2, which is quite feasible experimentally. [1] Bauschlicher and Ricca, Phys. Rev. B 70, 115409 (2004). [2] Yamada, Phys. Rev. B 69, 125408 (2004).

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