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Activation Process of GaAs NEA Photocathode and its Spectral Sensitivity

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Negative electron affinity (NEA) Gallium Arsenide (GaAs) photocathodes with high photo-electric conversion quantum efficiency (QE) and high response speed are expected as an electron source for THz frequency vacuum devices. To achieve high QE and high response speed, further understanding of the electron emission mechanism on NEA GaAs photocathodes is necessary. This study focuses on the formation process of NEA photo-electric surface on a GaAs photocathode. The results suggest that NEA photo-electric surface allows the electron emission from both the Γ and L valleys in the conduction band. On the contrary, in the Cs or O excess state, vacuum level is between the conduction band level at Γ and L point, and electrons can emit only from L valley, and cannot be emit-ted from the Γ valley due to the barrier of vacuum level.

Contribution of Γ and L valleys to the emission current was confirmed, of which balance depended on photo-electric sur-face conditions and excitation wavelength.