



Contribution ID: 1314 Contribution code: TUPA013

Type: **Poster Presentation**

Operation pressure and lifetime improvement of alkali photocathodes via graphene protection

Tuesday, 9 May 2023 16:30 (2 hours)

Protection of free-electron sources has been technically challenging due to lack of materials that transmit electrons while preventing corrosive gas molecules. Two-dimensional (2D) materials uniquely possess both of required properties. Here, we report three orders of magnitude increase in operation pressure and factor of two to four enhancement in the lifetime of high quantum efficiency (QE) alkali photocathodes (cesium potassium antimonide (CsK2Sb)) by protecting them with graphene. The photoelectrons were extracted through the graphene protection layer in a reflection mode, and we achieved QE of $\sim 0.14\%$ at ~ 3.4 eV, 1/e lifetime of 188 hours during operation, and no decrease of QE during operation at pressure of as high as $\sim 1 \times 10^{-3}$ Pa. In comparison, the QE decreased drastically at 10^{-6} Pa for bare, non-protected CsK2Sb photocathodes and their 1/e lifetime during operation was ~ 48 hours. We attributed the improvements to the gas impermeability and photoelectron transparency of graphene.

Funding Agency

Footnotes

I have read and accept the Privacy Policy Statement

Yes

Primary author: YAMAGUCHI, Hisato (Los Alamos National Laboratory)

Co-authors: POUDEL, Anju (Los Alamos National Laboratory); ALEXANDER, Anna (Los Alamos National Laboratory); LIU, Fangze (Los Alamos National Laboratory); WANG, Gaoxue (Los Alamos National Laboratory); VALDEZ, James (Los Alamos National Laboratory); DEFAZIO, Jeff (PHOTONIS USA Pennsylvania, Inc.); GUO, Lei (Nagoya University); YAMAMOTO, Masahiro (High Energy Accelerator Research Organization); Dr MOODY, Nathan A. (Los Alamos National Laboratory); TAKASHIMA, Yoshifumi (Aichi Synchrotron Radiation Center)

Presenter: GUO, Lei (Nagoya University)

Session Classification: Tuesday Poster Session

Track Classification: MC2: Photon Sources and Electron Accelerators: MC2.T02: Electron Sources