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Lifetime improvement of the CeB6 thermionic cathode at the X-ray free-electron laser facility SACLA by avoiding backward-accelerated electrons

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A CeB6 thermionic gun is presently operating for the X-ray free-electron laser (XFEL) facility SACLA. The gun emits high-intensity stable electron beams with a low-emittance of $0.6 \mu\text{m}$, however, the emission lifetime of CeB6 cathode was unexpectedly limited to only one year or less at the SACLA injector. Recently, it was predicted by a particle tracking simulation and measurements that a cause of the short lifetime was bombardment of high-energy electrons which were accelerated backward at the injector linac. The CeB6 gun tank was modified to detach the horizontal cathode position from the beam axis of injector in order to avoid the back-bombardment. By these attempts, the cathode lifetime was significantly prolonged and the XFEL operation became stable more than ever. In this conference, beam simulation and measurements of the backward-accelerated electrons and apparatus modification to improve the CeB6 cathode lifetime will be presented.

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Footnotes

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Yes

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