

# Basic development of mini CNT-FE X-ray tube for in-situ X-ray analyses of lunar surface material

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The mineral composition of planetary surface is one important key for investigation into evolution history of planets. Japan Aerospace Exploration Agency (JAXA) started to plan SELENE-2 lunar lander mission as post-SELENE lunar orbiter. We have planned a XRF/XRD X-ray probe analyzer to be carried on SELENE-2 to investigate mineralogical characteristics on the lunar surface materials. This instrument requires X-ray tubes as X-ray probe source to be operated. However, X-ray tubes have never been carried on previous spacecraft because of its large mass and size. In this study, we search the possibility of the carbon nanotube (CNT) based field emission (FE) type miniaturized X-ray tube (CNT-FE X-ray tube) to be carried on the spacecraft as a probe source of the X-ray analyzer. The objective of this study is to validate the possibility of CNT-FE X-ray tube by experiments. We developed the experimental setup for evaluation of the electron field emission from CNT film emitters, and carried out three other type CNT samples for a future miniaturized X-ray tube. As the results, the electron emission from CNTs and subsequent X-rays were confirmed. This presentation shows the possibility of the CNT-FE X-ray tube for planetary exploration, and the experiments of the field emission from CNTs.