

# Chemical and Electronic State X-ray Emission Analysis using SEM Equipped with Superconducting Energy Dispersive Spectroscopy for Carbon Fibers and Resins in CFRP

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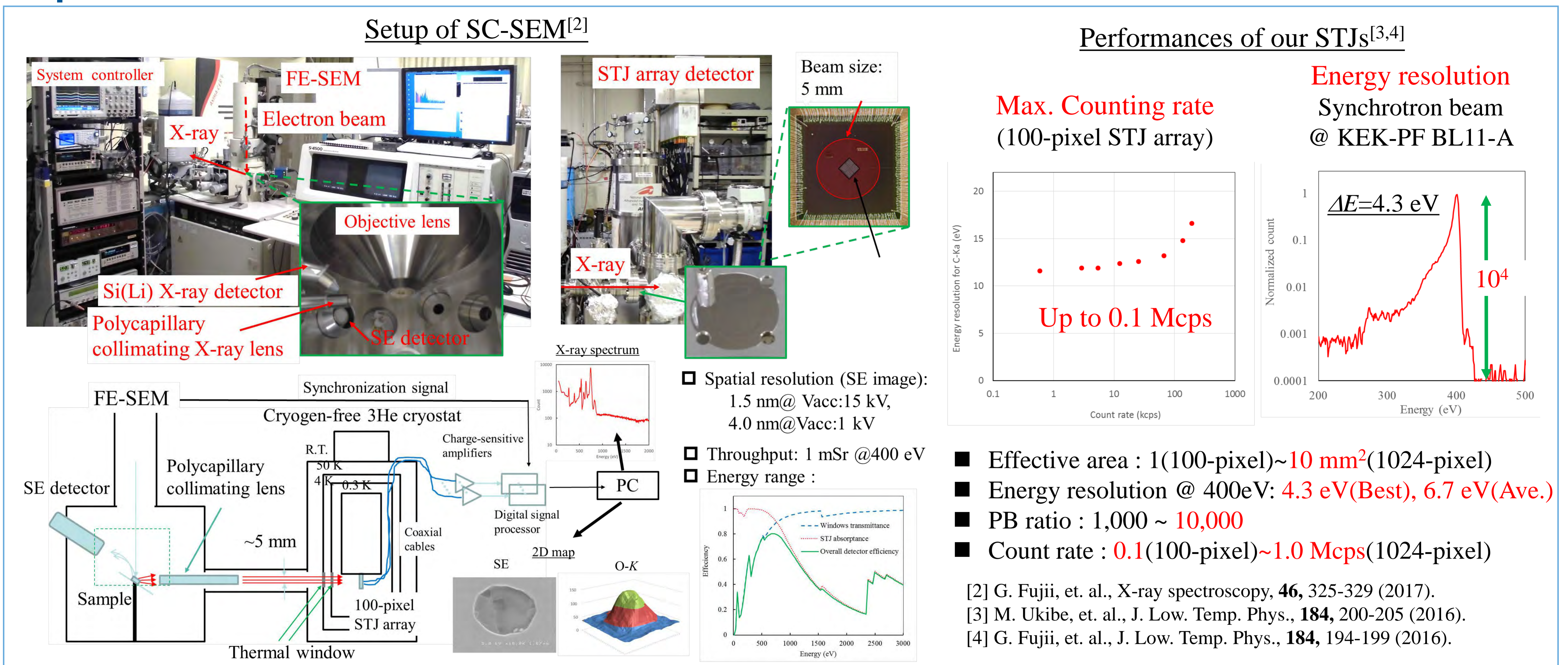


## Introduction

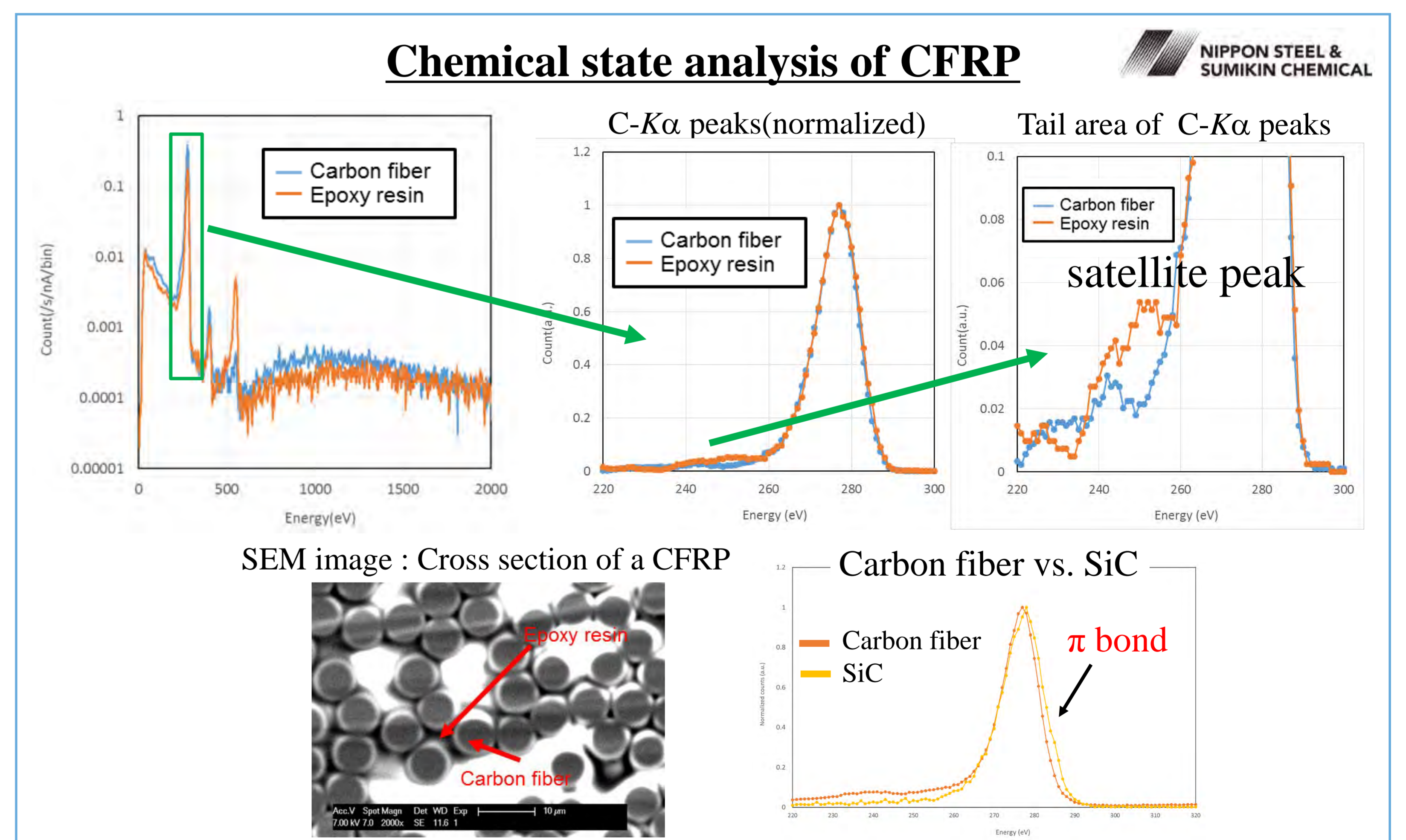
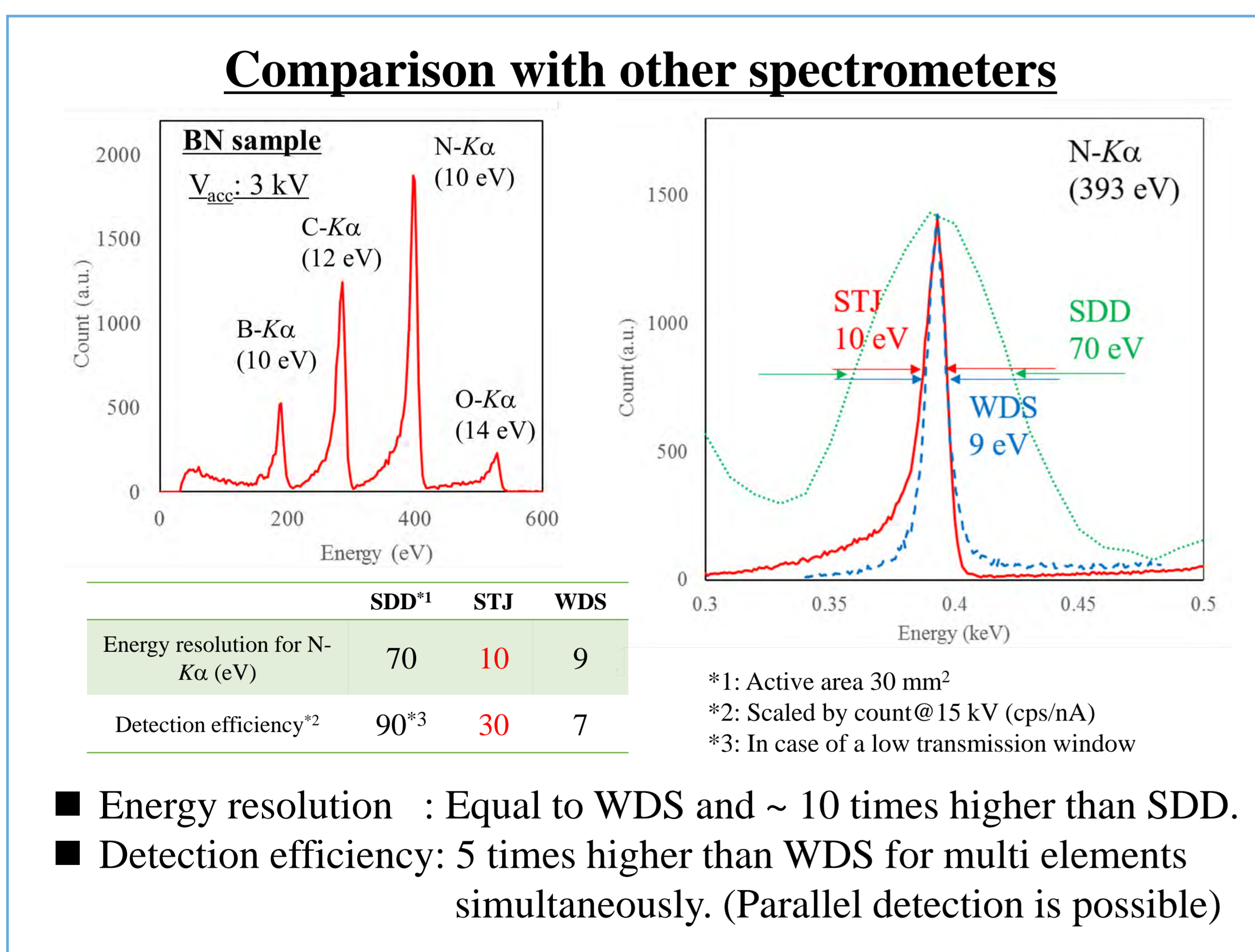
- By using **low acceleration voltage SEMs (LVSEMs)**, it is theoretically possible to identify and quantify an elemental composition of a sample with **a nanometer-scaled lateral resolution** [1]
- However, in LVSEMs, emitted fluorescence X-rays from samples are only **soft-X-rays with a low intensity**.
- Soft X-ray spectrometers should have high **throughput** as well as **high energy resolution**.
- We have been developing a SEM-EDS analyzer utilizing an **superconducting-tunnel-junction** array (SC-SEM), in order to realize analysis of light elements in structural or functional materials with nanometer scale. In this work, we performed chemical state analysis of carbon fibers and resins in a CFRP to demonstrate an X-ray emission analysis capability of SC-SEM.

[1] R Wuhler and K Moran, IOP Conf. Ser.: Mater. Sci. Eng., 109, 2016, 012019.

## Experiment



## Results



## Summary

- We have succeeded in realizing 100-pixel STJ array soft X-ray detectors with a high energy resolution (~5 eV) and detection efficiency (~10<sup>-3</sup> sr).
- A SEM-EDS analyzer utilizing an STJ array (SC-SEM) has been developed.
- SC-SEM can distinguish the difference of the C-K $\alpha$  peak shapes between different chemical states.