Heavy element analyses in EELS

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EELS and EDX are widely used as complementary analytical techniques in the analytical TEM. Traditionally EELS has been preferred for light element analyses and EDX for heavier element analyses. While EELS and EDX can be performed simultaneously in the TEM, frequently the experimental set-up is such that the conditions are not optimized for EDX and there is a detrimental effect on the quality of EDX data obtained. It would be advantageous if analyses of the heavier elements of interest could also be performed by EELS.

We are investigating the ability of EELS to analyse heavy elements in several systems of current importance such as PZT and HfO₂ and HfSiO based materials. We have previously shown that the Hf M-edges can be used to map the presence of Hf in a HfO₂/HfSiO gate stack deposited by International Sematech [1]. However, it is also possible to use the Hf N-edges to map the Hf signal. Thus it is possible to collect edges from Si, Hf and O in a single spectrum opening up the way to determine the metal to oxide ratio via EELS. Fig 1 shows an EELS spectrum containing the Hf N-edges and O K-edge from HfO₂. We have also had some success using the Pb N-edges to study the composition variation in PZT grown by a sol-gel method.

![EELS Spectrum](image_url)

**FIG. 1.** Hf N-edges and O K-edge from HfO₂.

References

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