

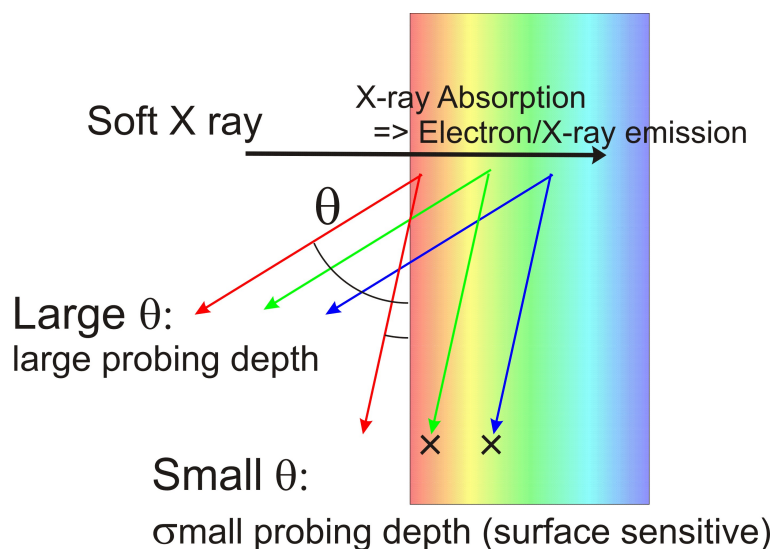
Development of sub-nanometer resolution depth-resolved XAFS/XMCD in the soft X-ray region towards operando measurements

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The depth-resolved soft X-ray XAFS/XMCD technique with sub-nanometer depth resolution has been developed and applied especially to magnetic thin films in this decade [1]. In the technique, the Auger electrons emitted after the X-ray absorption are collected at different detection angles, θ , as illustrated in Fig. 1, which correspond to different probing depths. A set of XAFS/XMCD spectra with different probing depths are then analysed, and sub-nanometer depth resolution is achieved. However, it had been impossible to apply the technique under magnetic or electric field, because the electron emission angle cannot be determined. Recently, the technique has been significantly improved by adopting the fluorescence-yield mode, which enables us the "operando" depth-resolved analysis under magnetic and/or electric fields [2]. In the fluorescence-yield depth-resolved XAS/XMCD technique, the fluorescence X rays are collected at different detection angles by a soft X-ray CCD camera with $< 0.1^\circ$ angle resolution, which leads to a sub-nanometer depth resolution. Examples for the depth-resolved XAFS/XMCD measurement under electric fields will be presented after the introduction to the technique.



Principle of soft X-ray depth-resolved XAFS/XAFS technique.

References

- [1] K. Amemiya, Phys. Chem. Chem. Phys. 14, 10477 (2012).
- [2] M. Sakamaki and K. Amemiya, Rev. Sci. Instrum. 88, 083901 (2017).