Developing time resolved Spin-Polarized LEEM

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Time Resolved Low energy electron microscopy (TR-LEEM) is a powerful *in-situ* technique for exploring the surface dynamic and static properties of thin films, like growth, phase transitions, reactions and magnetism. By addition of a pulsed spin-polarized electron source, we are developing a time-resolved spin polarized LEEM (TR-SPLEEM) at Chongqing University. It will be able to reveal details of ultrafast surface dynamics including spin and surface reactions with high spatial and temporal resolution. As the first phase of the project, a unique 3-MPA (Magnetic Prism Array) aberration-corrected LEEM has been commissioned. A lateral resolution of 1.8 nm has been achieved and a series of experiments have been carried out using this aberration-corrected LEEM [1]. A Wien-Filter-type ultrafast spin-polarized electron gun with a three magnetic lens system has been designed to minimize the deleterious effects of time broadening while maintaining full control of electron spin. The spin gun is under construction now, and will be installed to our TR-LEEM. The space charge effect and aberrations of the spin gun have been carefully studied. A spatial resolution of 2 nm and temporal resolution of 10 ps is expected in this newly designed TR-SPLEEM.

[1] W. Wan, L. Yu, L. Zhu, X. Yang, Z. Wei, J. Z. Liu, J. Feng, K. Kunze, O. Schaff, R. Tromp and W.X. Tang, Ultramicroscopy 174 (2017) 89-96