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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

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Development and Applications of Time-resolved Transmission Electron Microscopy for Magnetization Dynamics

In the past decades, fast progress has been made in the development and applications of time-resolved, ultrafast transmission electron microscopy (UTEM) techniques for direct observation of transient morphologies, structures and carrier dynamics of materials in real time and space, and has attracted great attentions in the vast fields of physics, materials science, chemistry, and biology [1]. In this talk, we firstly present some general aspect abouts the UTEM techniques, including the working principles, the historical development, current status and future perspectives. In particular, we outline the different developing stages of the UTEM instrumentations in our lab [2,3]. Secondly, we will present the Lorentz UTEM methodologies for studying magnetization dynamics in NiMnGa half-Heusler alloy and exemplify the temporal evolutions of different magnetic states and the dynamical processes of NiMnGa lamella upon femtosecond pulsed laser excitations [4]. Lastly, we will discuss the magnetization transition and relaxation phenomena in a topological helimagnet FeGe unveiled by laser-assisted Lorentz TEM observation, which is considered as another kind of time-resolved TEM techniques for ultra-slow magnetization dynamics.[5]

[1] A. H. Zewail, Science 328, 187-193 (2010).

[2] G.L. Cao, et al. Sci. Rep., 5, 8404 (2015).

[3] C.H. Zhu, et al. Ultramicroscopy, 209, 112887 (2020).

[4] M. Zhang, et al. Phys. Rev. Appl., 12, 034037 (2019).

[5] K. Chai, et al. Nanoscale, 152, 114202 (2020)

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