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In-situ measurements of hydrogenated Switching Mirrors

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1．背景と研究目的

Recently heat flow control technology has attracted a lot of focus for their possible application in reducing wasted heat[1]. A thermal switch can regulate the heat flow by switching between two higly different thermal conductivities states, that are controlled through external fields or chemical reactions. Swtichable mirrors are typically used for control of optical transmission: they reversibly transform into a semiconductor (transparent) or metal (opaque) state by a hydrogenation and dehydrogenation process[2]. Some of the switchable mirror materials also shows a drastic change in thermal conductivity, which make them also candidates for thermal switch devices. XAFS experiments on the different states can give an insight into the structural changes beyond these peculiar properties.

2．実験内容

We measured Mn-Mg and Gd thin films prepared by magnetron sputtering on quartz substrates. The thin films are covered with a 5 nm Pd layer to prevent oxidation and to facilitate hydrogen absorption. The samples were placed inside the quartz flow cell available at the beamline in order to perform measurements during hydrogenation in fluorescence mode.

3．結果および考察

Measurements of the Mn K-edge for the Mn-Mg thin films showed almost no changes between hydrogenated/dehydrogenated states. Comparison with reference spectra indicates that Mn structure is similar to metal Mn state (Fig. 1). For Gd thin film we measured Gd L_3-edge, and found that during hydrogenation the amplitude of the EXAFS signal is reduced and a slight shift indicates possible contraction of the Gd-Gd bond length (Fig. 2).

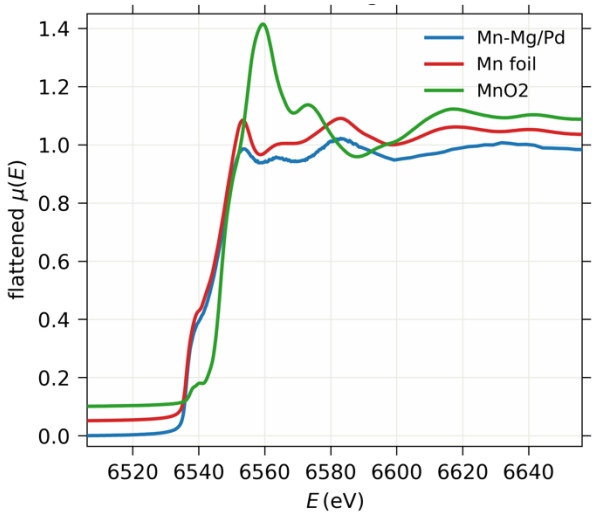

Figure 1: Mn K-edge of thin film and reference samples.

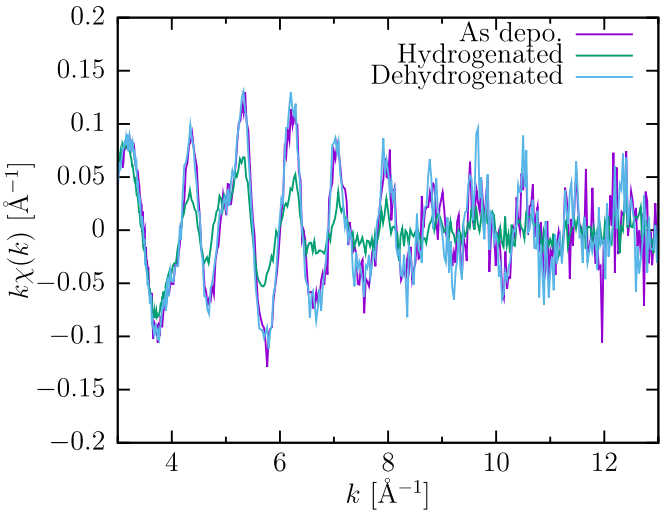

Figure 2: Gd L_3-edge EXAFS signal obtained for different states.

4．参考文献

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