

# Hydrogen-induced magnetism in $4f$ - $3d$ intermetallic compounds studied by XMCD

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Hydrogen-induced re-entrant magnetism has been recently discovered in magnetic Laves phase  $4f$ - $3d$  intermetallic compounds  $RFe_2$  ( $R=Gd$  and  $Y$ ) under hydrogen pressure. Reappearance of magnetism occurs above  $P_{H_2} \sim 10$  GPa after the complete disappearance of magnetism at  $1 \text{ GPa} < P_{H_2} < 10$  GPa due to hydrogenation to  $RFe_2H_x$  [1-3]. In the re-entrant magnetism phase of  $GdFe_2H_x$ , Fe moment is no longer ferrimagnetically coupled with Gd moment, and both moments align ferromagnetically. The drastic changes are regarded as a new class of the hydrogen effect on magnetism, however, a simple question “does the re-entrant magnetism occur in other  $4f$ - $3d$  intermetallic compounds?” arises. To answer this question, we measure X-ray magnetic circular dichroism (XMCD) of typical  $4f$ - $3d$  intermetallic compounds such as ferrimagnetic  $GdCo_2$  and  $GdNi_2$  under hydrogen pressure up to  $\sim 30$  GPa, and appearance of re-entrant magnetism is investigated. Recent results of the hydrogen effects on XMCD spectra will be demonstrated.

[1] T. Mitsui *et al.*, J. Phys. Soc. Jpn **85**, 123707 (2016).

[2] T. Mitsui *et al.* J. Alloys Comps **580**, S264-S267 (2013).

[3] N. Ishimatsu *et al.*, SPring-8/SACLA Res. Rep. **4**, 1 (2016).

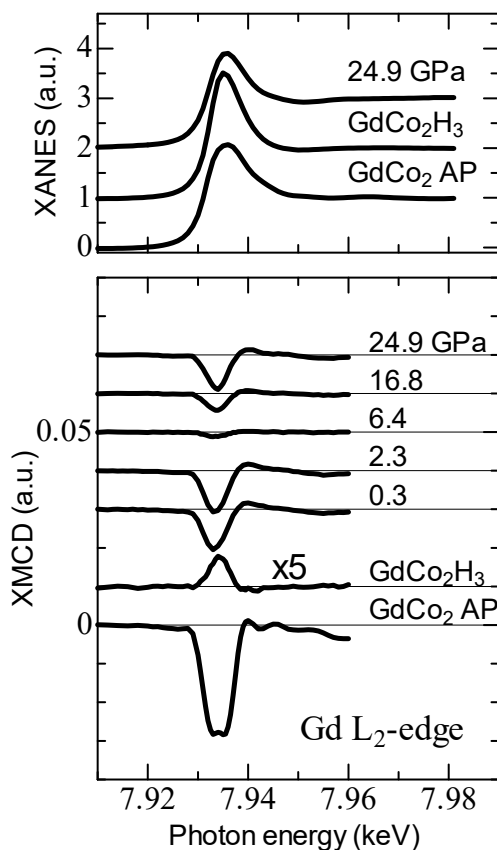


Figure: Hydrogen-induced changes in XANES (top) and XMCD (bottom) spectra of  $GdCo_2H_x$  at the Gd  $L_2$  edge.