X-ray characterization of a high performance hydrogen storage alloy with laser surface modification

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Abstracts: *A femoto-second laser as well as a nano-second laser repetitively illuminates the whole surface sequentially on a hydrogen absorption alloy resulting in significant improvement of the hydrogen absorption rate. In order to characterize the surface layer, we perform x-ray diffraction experiment using SPring-8 BL-22XU synchrotron radiation facility*

For continuous human activities, electric storage techniques become important in the fields of electric power supply. For contributing such issue, we have been studying hydrogen absorption alloys with surface modification by short pulse lasers. The initial rates of hydrogen absorption and desorption of a hydrogen storage alloy are one of the important performances to be improved. On the basis of the previous experimental study using accelerators [1], charged particles cause surface modifications on the alloys resulting in improvement of the hydrogen absorption rate while these machines also cause radioactivity. The vacancies introduced into a hydrogen absorption alloy are found to be positive effect on the improvement of the initial hydrogen absorption rate. We also have tried to make an improvement of the absorption rate with an ultra-high intensity laser driven proton beam [2]. Based on these result we convince that direct laser illumination makes us good performance of the alloy. A femoto-second laser as well as a nano-second laser repetitively illuminates the whole surface on a tip of a few cm diameter $LaNi_{4.6}Al_{0.4}$ alloy resulting in significant improvement of the hydrogen absorption rate given by the electric-chemical experiments. In order to characterize the surface layer, we perform x-ray diffraction experiment using SPring-8 BL-22XU synchrotron radiation facility resulting in finding a suitable condition for enhancing absorption rates of the hydrogen storage alloys. From the result, the short laser hits the surface and it causes the pressure which is applied to the interior of the alloy. It makes suitable defects in the surface layer of the alloy. Based on the present experimental results, we discuss on the mechanisms of laser driven surface modification.

References

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