# §16. Research and Development of Wall Conditioning Techniques for LHD

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So far, wall conditioning of LHD has been performed by discharge cleaning and titanium gettering. However, considering various limiation to conditioning methods due to superconductor magnetic fields, it is important to develop more powerful and convenient methods which are applicable to LHD. In this research, we focus on lithium conditioning and ECR boronization as promising techniques for LHD. The lithium conditioning can be powerful tool[1-5] to reduce oxygen impurity and hydrogen recycling. The ECR boronization can be speedy wall conditioning without turning off magnetic field produced by superconductor. The purpose of this reserch is to clarify possible problems of the lithium conditioning technique when they are applied to LHD.

The experiment was performed in SUT device in NIFS. A stainless steel oven (~2cm$^3$) is placed on the bottom of the vessel. Solid lithium is put in the oven, which can be heated to 450 °C. A deposition monitor enables us to measure the deposition rate of lithium without opening the vessel. A graphite sample (HOPG or isotropic graphite) is placed at a position of the vessel wall by a sample holder. After lithium deposition, the graphite sample is transferred to the surface analysis chamber and depth profile of atomic composition is measured by in-situ Auger electron spectroscopy. Samples can be heated up to 250 °C, to investigate the annealing effect on the lithium depth profile.

Figure 1 shows the depth profile of lithium-deposited nickel and graphite samples. Even though the deposited amout of lithium is same, the depth profile of lithium is quite different. In case of graphite sample, lithium diffuses into graphite bulk. Figure 2 shows lithium-deposited graphite samples with and without hydrogen discharge treatment prior to lithium deposition, where the treatment was beem performed by a DC glow discharge at 30 mTorr $H_2$ for 2 hours. Ion bombarding energy and current density to the sample are ~200eV and a few tens μA, respectively. In case of the graphite sample with hydrogen discharge treatment, lithium concentration becomes rather high compared with the non-treated graphite sample. Thus the lithium depth profile is strongly affected by surface condition of graphite. The mechanism of this phenomena is now under study.

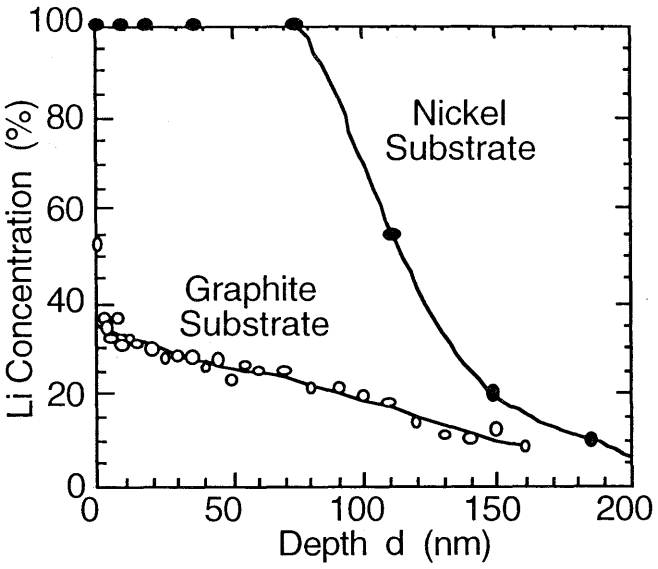


Fig. 1. Auger depth profile of lithium on nickel (closed circles) and graphite (open circles) substrates.

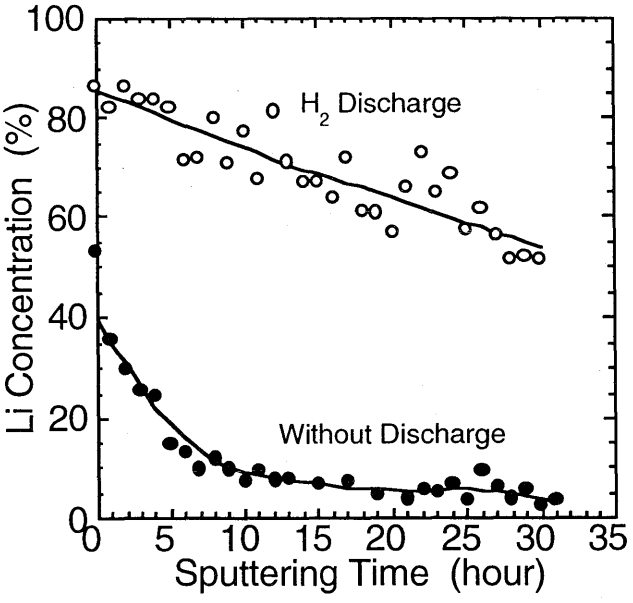


Fig. 2. Auger depth profile of lithium deposited on graphite samples with (open circles) and without (closed circles) hydrogen discharge treatement.

References
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