Experimental study of light element depth distribution in metals and alloys

Diffusion studies of crystalline solid are important in materials physics. However experimental study of light element diffusion in alloys is a challenging task as most of studies fail to probe light element depth distribution with good depth resolution. To overcome these difficulties, we have developed a coincidence ERDA experimental set up for high resolution depth profiling of light elements in thin foils [1]. Simultaneous depth profiling of two light elements could be performed using this experiment. In this project, light element will be introduced by ion implantation and depth distribution will be studied in self-supporting thin foils by coincidence ERDA at various temperatures (ex-situ, if possible in-situ). This could be useful to understand light element diffusion and impurity-defect interactions in metals. With this method, example studies are, (i) H, He depth distribution in Tungsten: High resolution depth profiling of H and He is important in Tungsten owing to its importance as a nuclear structural material. (ii) C in FeCo alloys: FeCo is a ferro magnetic material and studies of C diffusion is important hence it modifies magnetic properties [2]. Coincidence ERDA experiments can be used for in-situ experiments and we encourage for new ideas and studies from students. Students will involve in preparing thin foil samples, coincidence ERDA experiment, analysis of results and develop in-situ heating if possible.

1. In-operando observation of Li depth distribution and Li transport in thin film Li ion batteries featured. Appl. Phys. Lett. 117, 023902 (2020); https://doi.org/10.1063/5.0014761.
2. Influence of ion implantation on the magnetic properties of thin FeCo films. Journal of Applied Physics 97, 073911 (2005); https://doi.org/10.1063/1.1875737.

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