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(UG*) (POS-53) Multimodal approach towards to hydrogen depth profiling

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Many fundamental science processes and engineering designs are affected by the presence of hydrogen, e.g. hydrogen embrittlement. In order to understand fundamental issues in these materials and devices, quantifying the amount of hydrogen is needed. A method with high sensitivity is critical to improve current hydrogen analysis techniques to understand hydrogen related processes. To overcome these limitations, a new method called medium energy elastic recoil detection analysis (ME-ERDA) is adapted from two existing techniques –elastic recoil detection analysis (ERDA) and medium energy ion scattering (MEIS). ME-ERDA successfully detects hydrogen at surfaces and interfaces with a resolution of ˜10 Å. An important aspect of analysis is quantifying the amount of hydrogen in a material, a process which requires a calibration standard with a large known amount of hydrogen. Improving hydrogen analysis methods will be achieved by synthesizing calibration standards made of thin metal hydrides, particularly titanium hydride (TiHx), and quantifying the amount of hydrogen in the standards. This will be accomplished by depositing titanium on a Si (001) wafer via magnetron sputter deposition (Western Nanofab). Forming the metal hydride will be done using two methods: 1) annealing in a hydrogenated environment, and 2) galvanostatic polarization. A hydrogen depth profile has been done using ERDA (Western Tandetron Accelerator Lab), secondary ion mass spectrometry (SIMS) (Surface Science Western), and ME-ERDA; with an emphasis on improving the resolution of ME-ERDA by adjusting the detector setup. To gain insight into hydrogen sensitivity and depth resolution for these techniques, a comparative analysis will be made between ME-ERDA, ERDA, and SIMS. This newly developed ME-ERDA technique and the establishment of hydrogen standards hold significant importance for future engineering applications requiring hydrogen depth profiling, as well as for advancing our fundamental understanding of hydrogen related processes.

Keyword-1

Titanium Hydride

Keyword-2

Hydrogen Depth Profiling

Keyword-3

ME-ERDA

Primary authors: GRIFFITH, Casee; NOËL, James (Western University); GONCHAROVA, Lyudmila

Presenter: GRIFFITH, Casee

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