Project Title: Plasma Treatment for High-Density Hydrogen Cluster Formation

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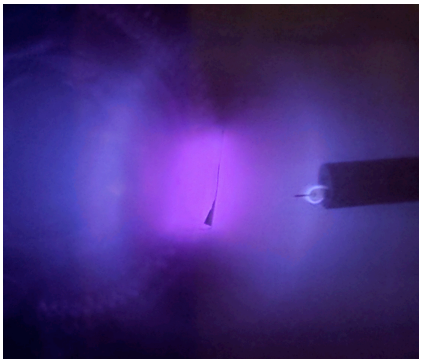
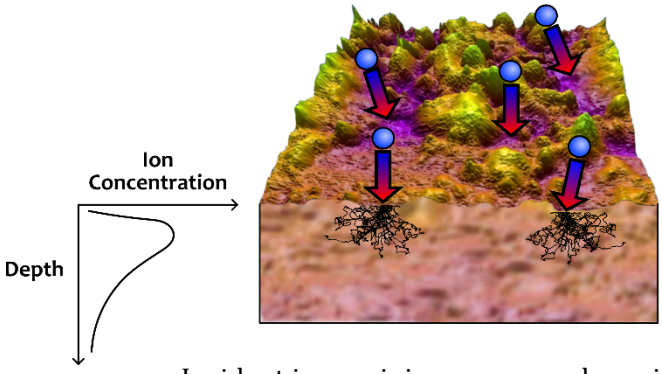
Project Description:

Since hydrogen is the lightest, smallest, and most abundant element, coupled to its reactivity, the metal-hydrogen interaction is inescapable. An essential feature of this interaction is the binding of hydrogen to defects beneath the surface of the metal. Some hydrogen occupied defect sites are long-lived with high binding energies that conglomerate to form clusters which subsequently affects the material's bulk properties. These tightly bound sites are relevant to a variety of fields from fuel cells, superconductivity, and fusion and fission reactors.

The goal of this current project is twofold: to utilize a plasma processing technique to produce these localized clusters efficiently, and to implement samples with high concentrations of hydrogen as a type of Inertial Confinement Fusion (ICF) target. This method of energy production was previously investigated as a type of fusion-based propulsion. The figures below depict the current use of a DC glow discharge along with the corresponding ion bombardment scheme. The scheme portrays the ion trajectories which simultaneously produce defects while introducing hydrogen into the metal.



Plasma localized on cathode sample



Incident ions gaining energy and causing surface and subsurface morphology changes

Student Background and Expected Research Activity:

We are currently looking for undergraduate students to assist in laboratory research. Student tasks will include helping graduate students work with high vacuum equipment, HV power supplies, plasma characterization, and radiation detection. It would be preferable to have taken an experimental lab course or is willing to learn lab techniques.

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