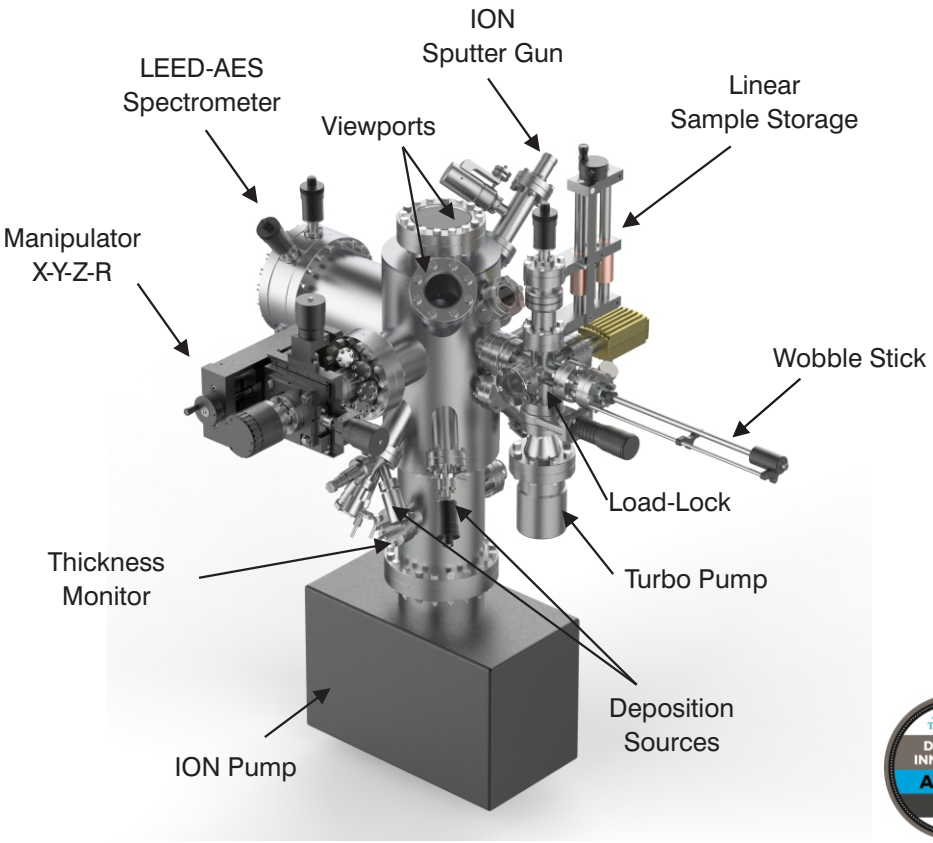
Lithium Diffusion Tester

Model LDT200



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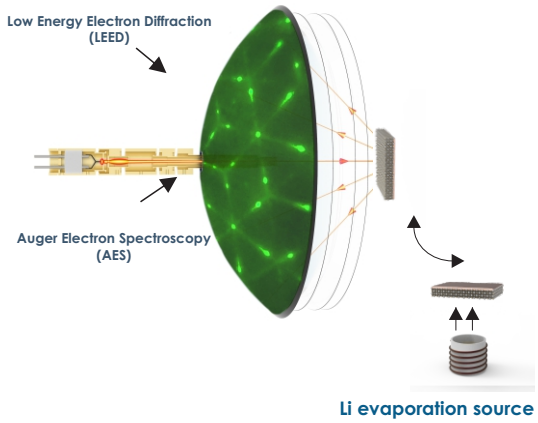
Experimental Set-up
Probing Depth: few nanometres



Li evaporation source

Method Description:

Lithium Diffusion Tester, Model LDT200 is a complete ultra-high vacuum system to characterize the lithium concentration on the surface of tested material and surface crystallographic changes on single-crystal substrates. It has the capability to measure the Lithium diffusion rate and diffusion activation energy using variable temperature sample stage from cryogenic temperatures to 1000 C. This method is based on creating a concentration gradient of Lithium on the surface by evaporation of Lithium on tested material in an ultra-high vacuum environment and tracing Lithium concentration using Auger electron spectroscopy (AES). The structural effect of lithium deposition and diffusion on the host materials is measured on the surface using Low Energy Electron Diffraction (LEED). The capacity of tested material for Lithium storage can be also measured using this method.

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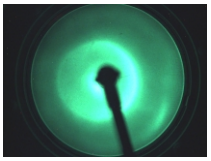
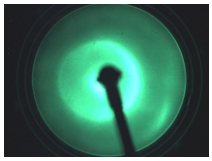
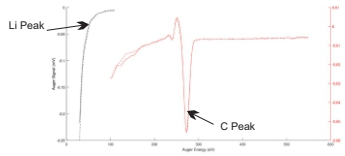
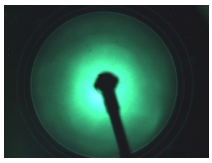
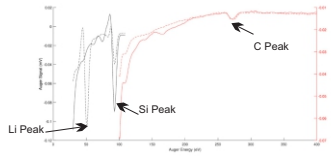
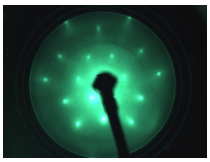
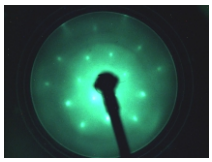
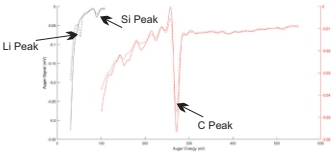
MODEL LTD 200

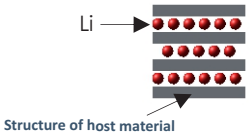
Experimental Data

Substrates and Results

	LEED-Clean	LEED-5Å	AES Spectrum (Before/After Li Evaporation)
HOPG(Graphite) Strong Li Diffusion no change to surface crystalline structure			
Si(111) No Li Diffusion drastic change to surface crystalline structure			
SiC-6H Some Li Diffusion small effect on surface crystalline structure			

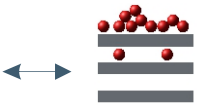
All experiments at temperature 300K

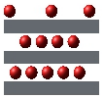
Classification of characterized materials:



"Rapid lattice diffusion": Materials with "natural rapid Li diffusion in lattice structure: **HOPG (Graphite)** and no effect on long-range surface structural order

"No lattice diffusion": Materials with no "natural" Li Diffusion and strong effect on long range structural order such as polycrystaliation or amorphization: Si(100), Si(211),SrTiO2,Ga2O3





"Moderate lattice diffusion": Materials that have moderate "natural" Li diffusion and some effect on the long range polycrystalization structural order : SiC, CVD Diamond, LiNb2O3,TiO2, TiO2/Si(111), Cds and InP

Comparasion of Li diffusion in SiC single crystals and polycrystalline structures

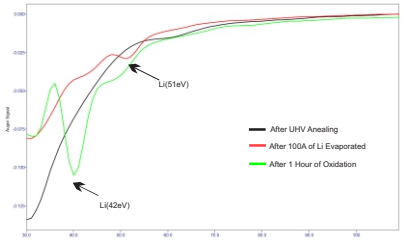
All experiments at temperature 300K

Process	SiC-6H C face	SiC- Recrystallized, very low Si present on the surface
After UV cleaning	Si-92eV: 0 mV	Si-92eV: spectrum is "bent"
After 100 A of Li evaporation	Si-92eV: 0 mV Li-52 eV: 4 mV	Si-92eV: 0 mV Li-52 eV: 6.6 mV

Conclusion: Li lattice diffusion is more preferential in single crystals then in the polycrystalline structures

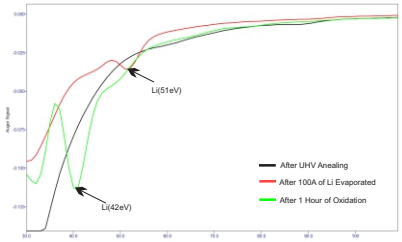
Oxygen exposure of SiC with an evaporated dose of Li-100 Å at temperature 300K

SiC-6H C face with 100A of evaporated Li



Li Auger peak is **19 times** larger after oxidation and shifted to 42eV

SiC-Recrystalized with 100 A of evaporated Li



Li Auger peak is **8 times** larger after oxidation and shifted to 42eV

Conclusion: Lithium is diffusing from bulk to surface to form Lithium Oxide

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