AAS 237, UV-Vis TIG

New approaches to UV optical coatings with atomic layer engineering

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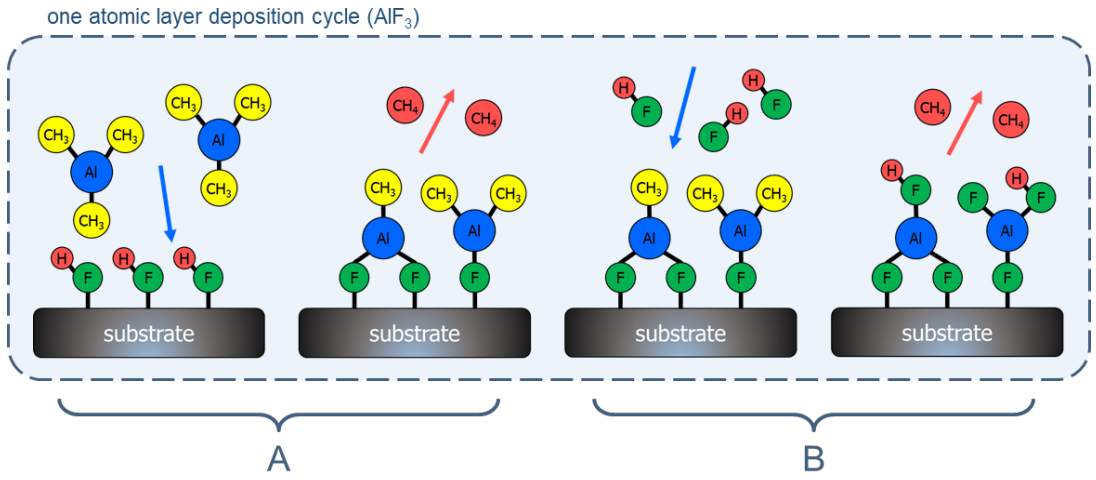
Metal fluoride ALD and ALE processes

Material	Co-reactant with Anhydrous HF	T (°C)	~λ Cutoff (nm)
MgF_2	bis(ethylcyclopentadienyl) magnesium	100-250	115-120
AlF_3	trimethylaluminum	100-200	105-110
LiF	lithium bis(trimethylsilyl)amide	100-250	95-100
LaF_3	lanthanum tris(formamidinate)	150-250	125-135



- Possible advantages of atomic layer deposition (ALD) in environmental stability and repeatability/complexity versus physical vapor deposition (PVD) coating methods
- Thermal atomic layer etching (ALE) useful for gently removing native oxide from aluminum Initial work on FUV protected-Al mirror coatings and metal dielectric filters integrated onto delta-doped UV detectors
- Interested in dichroics, linear variable filters, narrowband mirror coatings in λ ≈ 100–320 nm

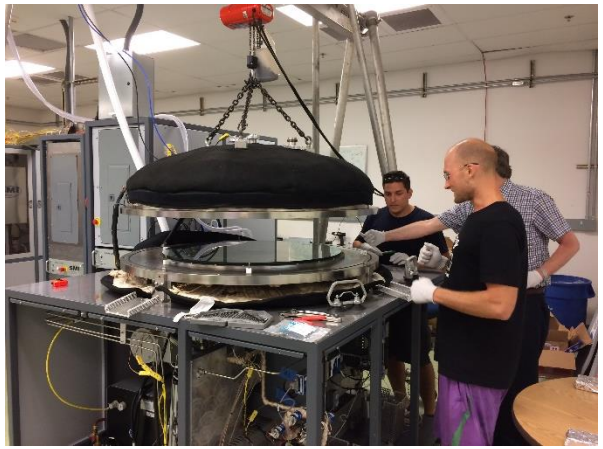
LiF-protected Al mirror coatings with improved stability

100 mm convex SISTINE secondary overcoated at JPL

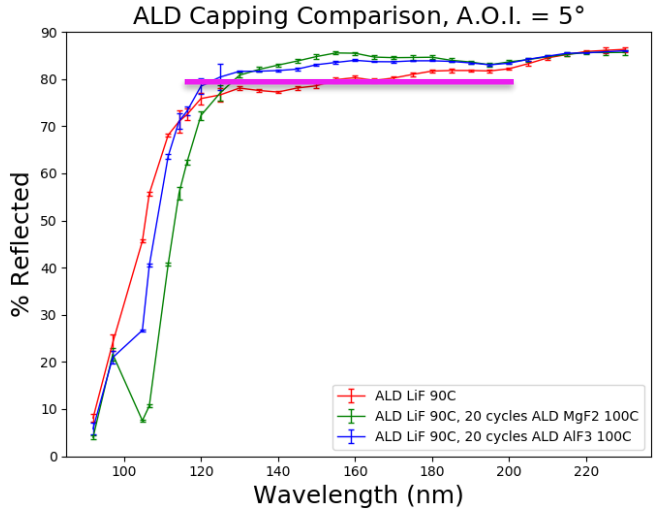
thin cap AlF_3 or MgF_2 (1-2 nm)
ALD LiF (~15-18 nm)
ALE interface treatment

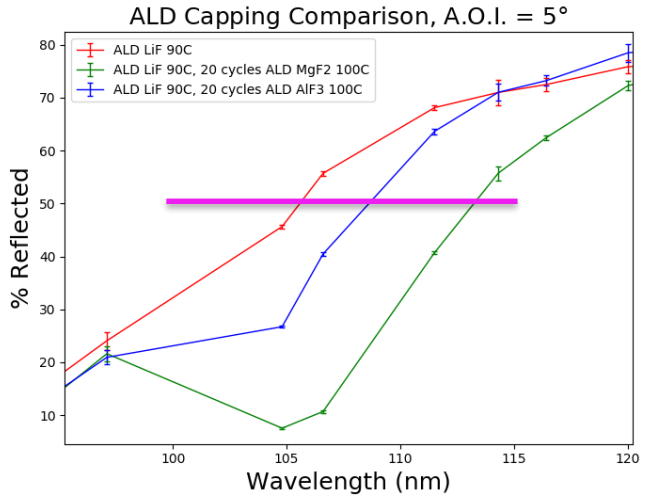
evaporated Al

Meter-class ALD tool at UCSC (Prof. N. Kobayashi)



Evaluation of 'all-ALD' mirror coating at CU Boulder (P. Hinton, B. Fleming, K. France)

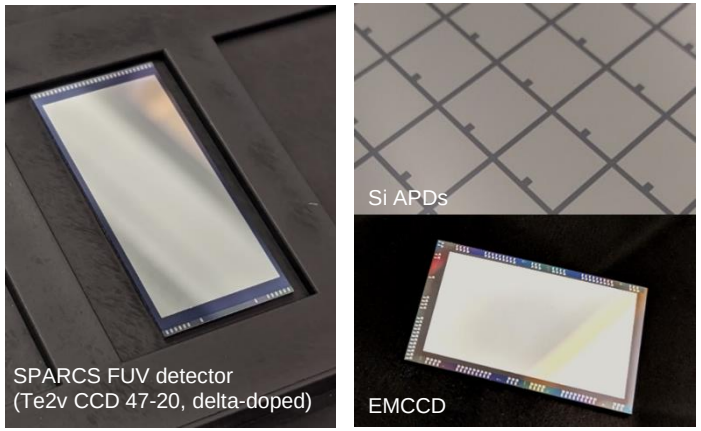


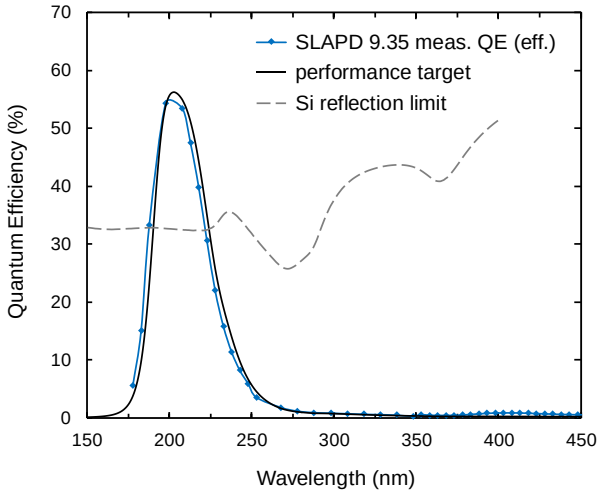


= LUVOIR requirements

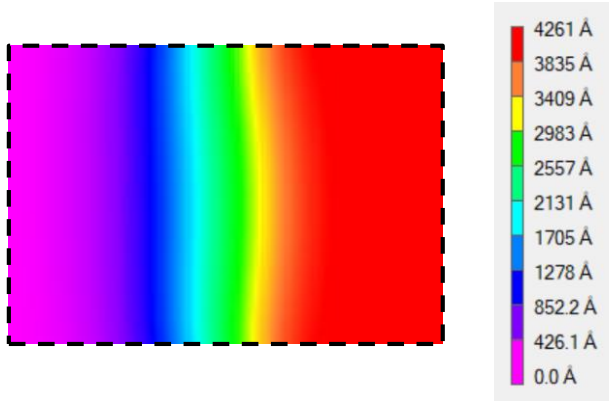
Integrated bandpass filters and beyond

Delta-doped APDs & CCDs with integrated solar-blind filters

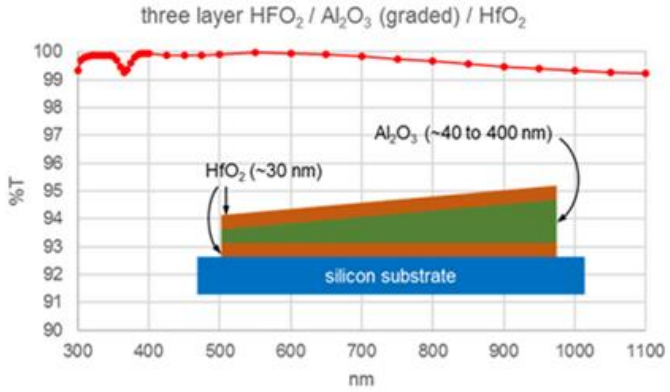




Spatial mapping of graded thickness, three layer coating on Si (~3.5 x 5 cm area)



- Multi-layer metal dielectric filters can be integrated directly on delta-doped, back-illuminated detectors for solar-blind operation
- 7 layer filter developed for SPARCS CubeSat, λ~160 nm (E. Shkolnik, UA)
- Baselined for SMEX-MO Dorado, λ~195 nm (B. Cenko, GSFC)



- Graded-thickness coatings for spectroscopy applications
- Or selective deposition for multi-channel operation on the same detector (ROSES APRA, A. Jewell, JPL)