

# Surface chemistry analysis of hot lithium coatings on porous Mo substrates

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# Experimental conditions (porous Mo samples)

## Mo001

- Virgin sample
  - PPI\*
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS
- 15 min  $\text{D}_2$  irradiation
  - XPS
- 15 min  $\text{D}_2$  irradiation  
(30min cumulative)
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

## Mo002

- Virgin sample
  - PPI\*
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - RGA during dep.
  - XPS following dep.
- Heated to 255 C
  - RGA data recorded
  - Melting after 6 min. at 250 C
  - 30 min  $\text{D}_2$  irradiation began 14 min into heating
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

## Mo101

- Virgin sample
  - PPI acid clean\*
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS following dep.
- Heated to 360 C
  - RGA data recorded
  - Melting after 6 min. at 210 C (*video-not included*)
  - XPS
  - Wait 1 day
- 30 min  $\text{D}_2$  irradiation
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

## Mo201

- Virgin sample
  - PPI\*
- 5  $\mu\text{m}$  Li deposition
  - RGA data taken
  - Detailed video
- TDS at 550 C
  - XPS

- As of April 11, LLD has total 79.26 g evaporated in NSTX
- For Purdue experiments, 2  $\mu\text{m}$  =  $1.06 \times 10^{-4}$  g, 3  $\mu\text{m}$  =  $1.59 \times 10^{-4}$  g

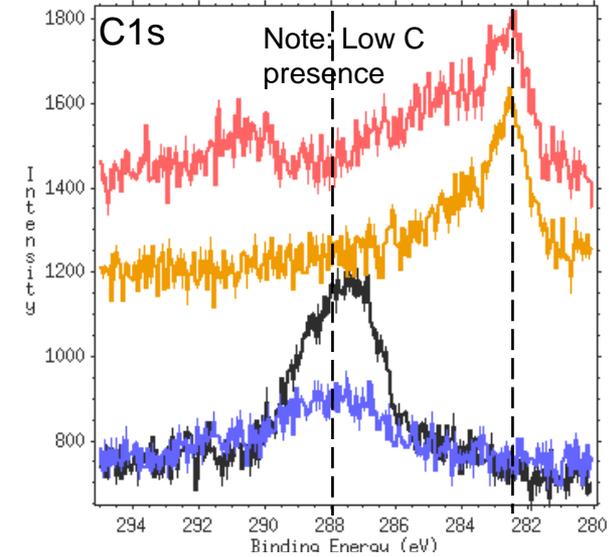
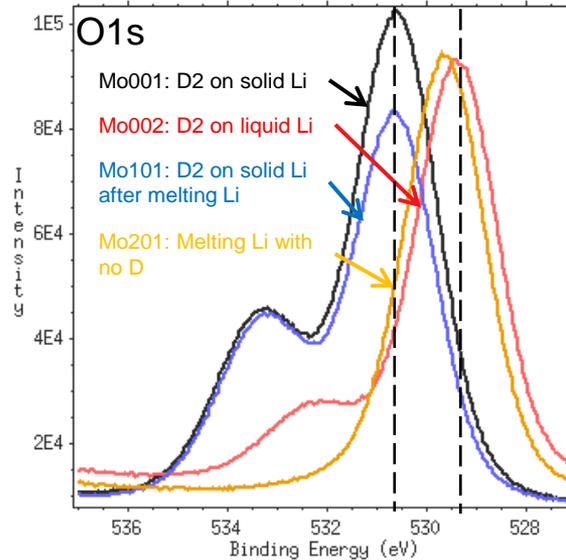
\*PPI samples from Scott O'Dell



# What happens during irradiation?

:: Date= 100216; Sample= Mo001; Comment= 2knm Li-Dep, 15min Irrad-rate= 100216; Sample= Mo001; Comment= 2knm Li-Dep, 15min Irrad  
 red :: Date= 100223; Sample= Mo002; Comment= Li-2um, D2-30m at 3d :: Date= 100223; Sample= Mo002; Comment= Li-2um, D2-30m at  
 lue :: Date= 100403; Sample= Mo101; Comment= Li-2um, (350 C), w-1d; :: Date= 100403; Sample= Mo101; Comment= Li-2um, (350 C), w-1d  
 orange :: Date= 100406; Sample= Mo201; Comment= Post Li-5u TDS (5nge :: Date= 100406; Sample= Mo201; Comment= Post Li-5u TDS (

- Mo001: D2 on solid Li
- Mo002: D2 on liquid Li
- Mo101: D2 on solid Li after melting Li
- Mo201: Melting Li with no D



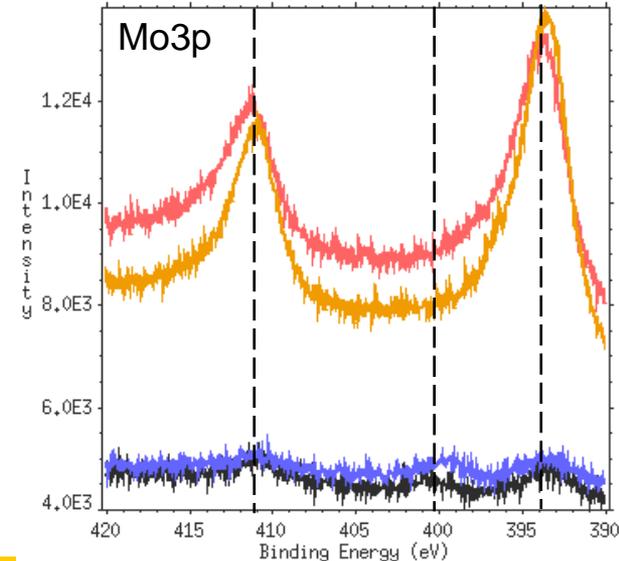
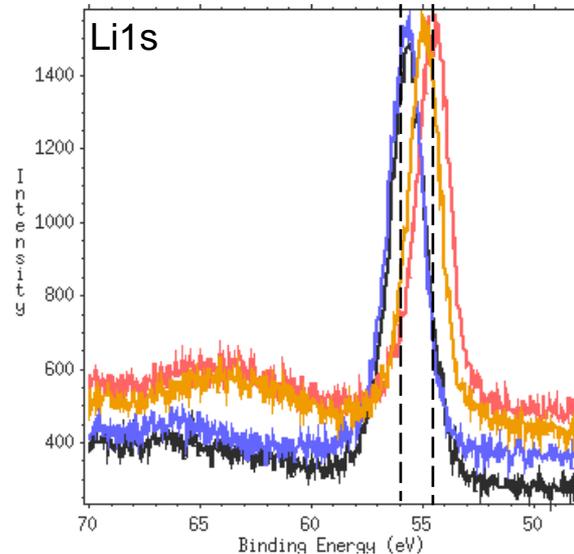
## Metallic Concentrations

	% Li	% Mo
Mo001	99.033	0.967
Mo002	98.766	1.234
Mo101	98.791	1.209

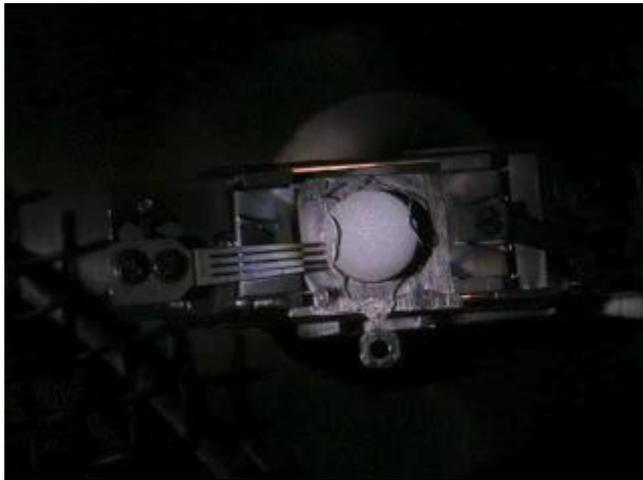
After Li deposition

## Li, Mo, C, O Concentrations

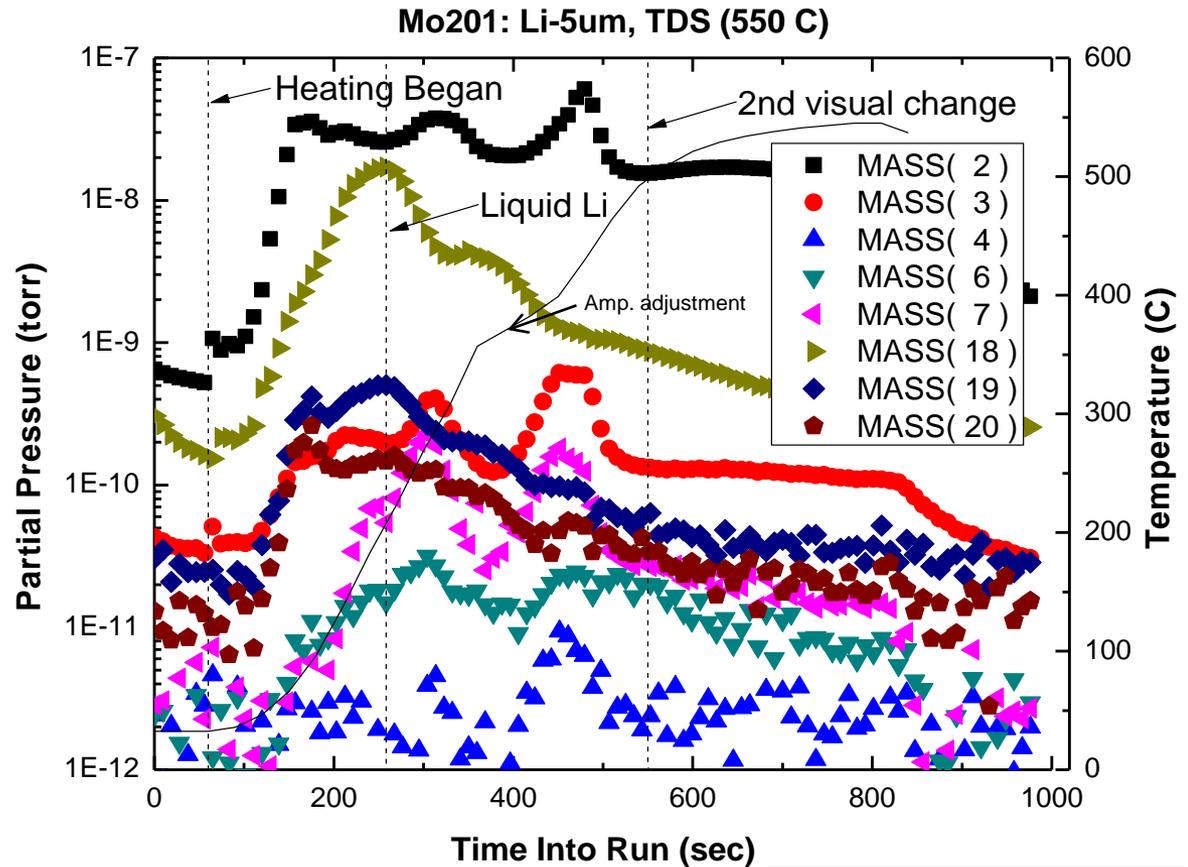
	% Li	% Mo	% C	% O
Mo001	85.023	0.830	2.866	11.281
Mo002	86.294	1.078	5.089	7.539
Mo101	71.669	0.877	4.593	22.860



# Melting of lithium on Mo201



Movie

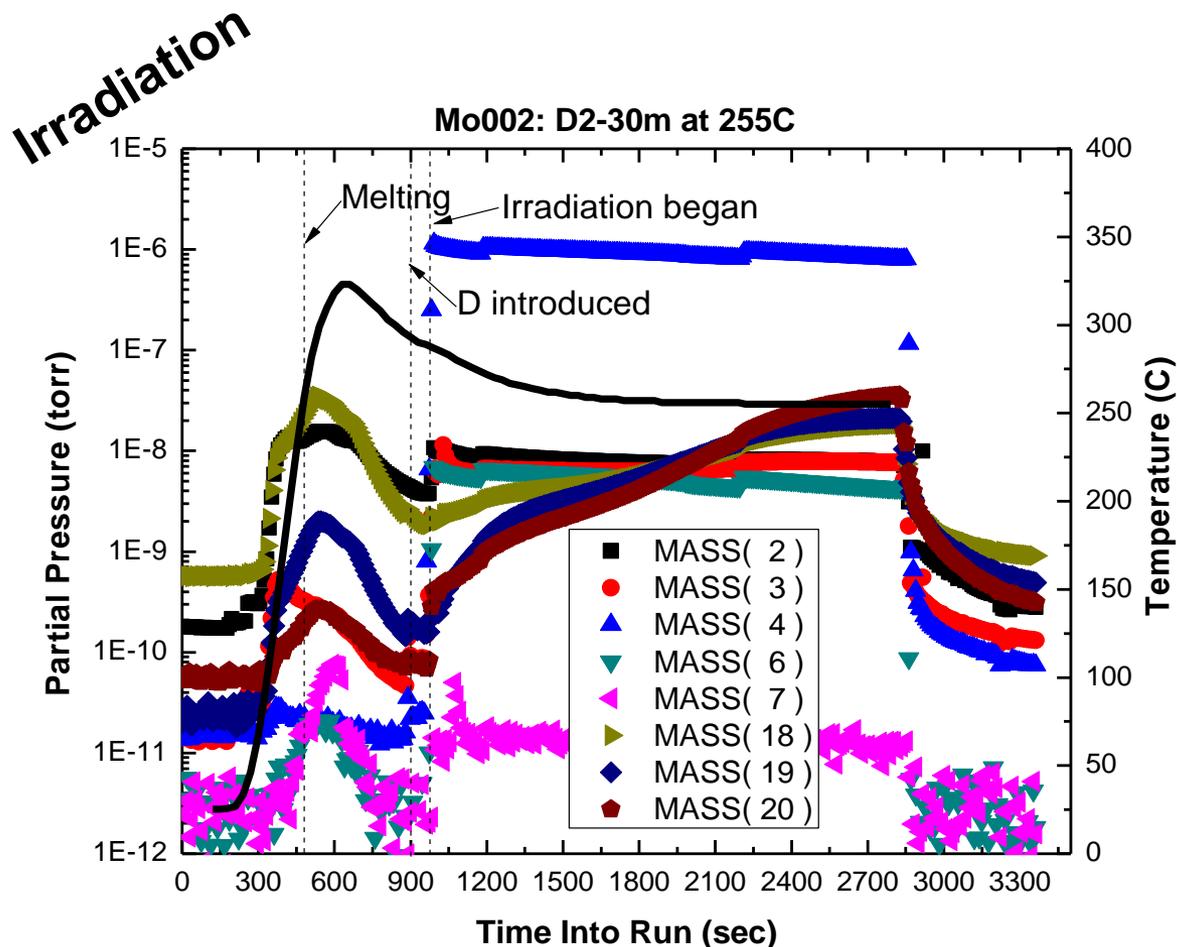


Heat rate ~ 2 C/sec

# D irradiation on hot Mo-Li (2 $\mu\text{m}$ )

## Mo002

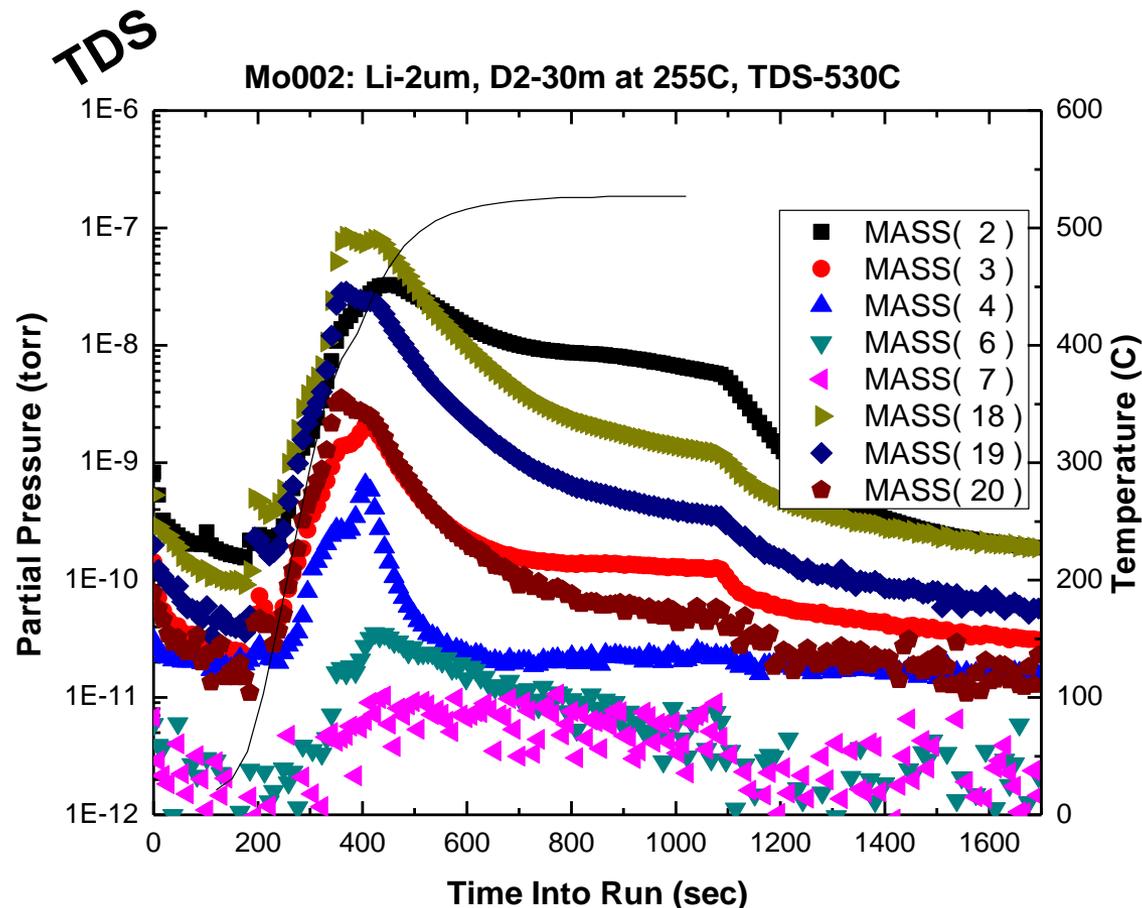
- Virgin sample
  - PPI
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - RGA during dep.
  - XPS following dep.
- Heated to 255 C
  - RGA data recorded
  - Melting after 6 min. at 250 C
  - 30 min D<sub>2</sub> irradi. began 14 min into heating
  - XPS
- TDS at 550 C
  - Li started as solid
  - RGA data recorded
  - XPS



# D irradiation on hot Mo-Li (2 $\mu\text{m}$ )

## Mo002

- Virgin sample
  - PPI
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - RGA during dep.
  - XPS following dep.
- Heated to 255 C
  - RGA data recorded
  - Melting after 6 min. at 250 C
  - 30 min D<sub>2</sub> irradi. began 14 min into heating
  - XPS
- TDS at 550 C
  - Li started as solid
  - RGA data recorded
  - XPS



# *EXTRA SLIDES*

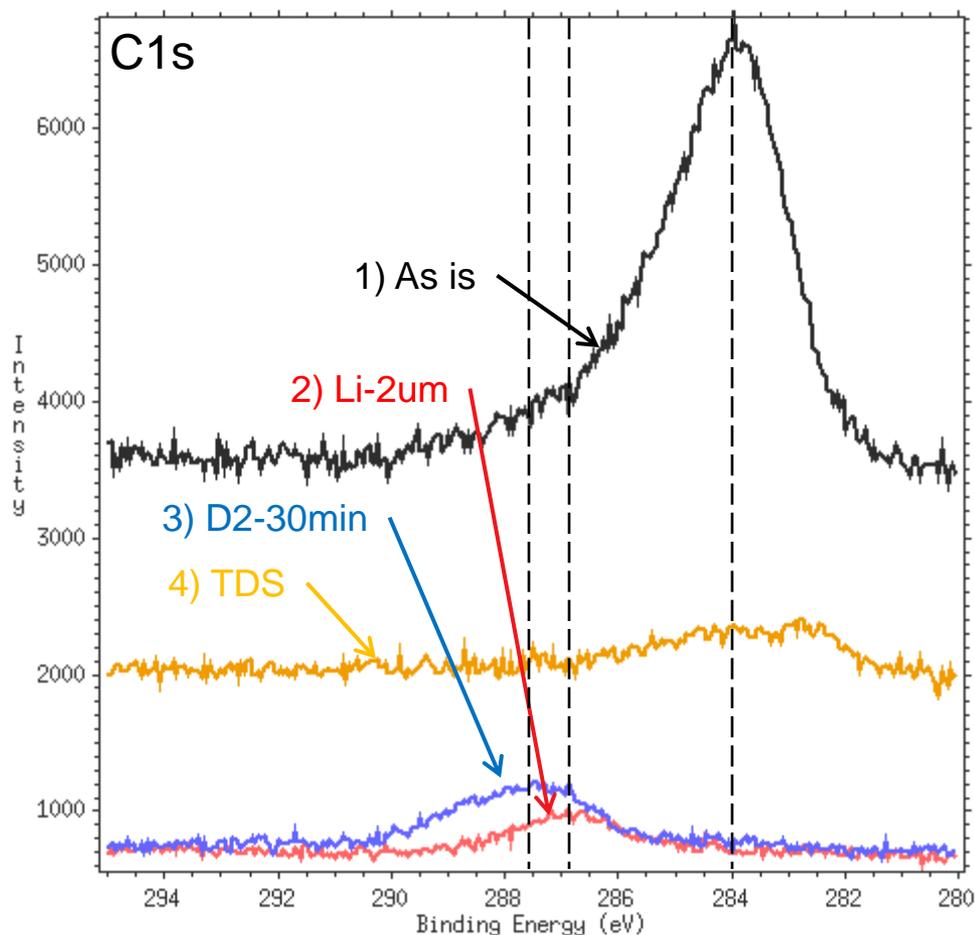


# Moly with Li and D, no temperature

black :: Date= 100216; Sample= Mo001; Comment= As is scan  
red :: Date= 100216; Sample= Mo001; Comment= 2knm Li-Dep  
blue :: Date= 100216; Sample= Mo001; Comment= 2knm Li-Dep, 15min Irrad-D2 (30m to  
: Date= 100218; Sample= Mo001; Comment= 2knm Li-Dep, 15min Irrad-D2 (30m tot),wait 1.!

## Mo001

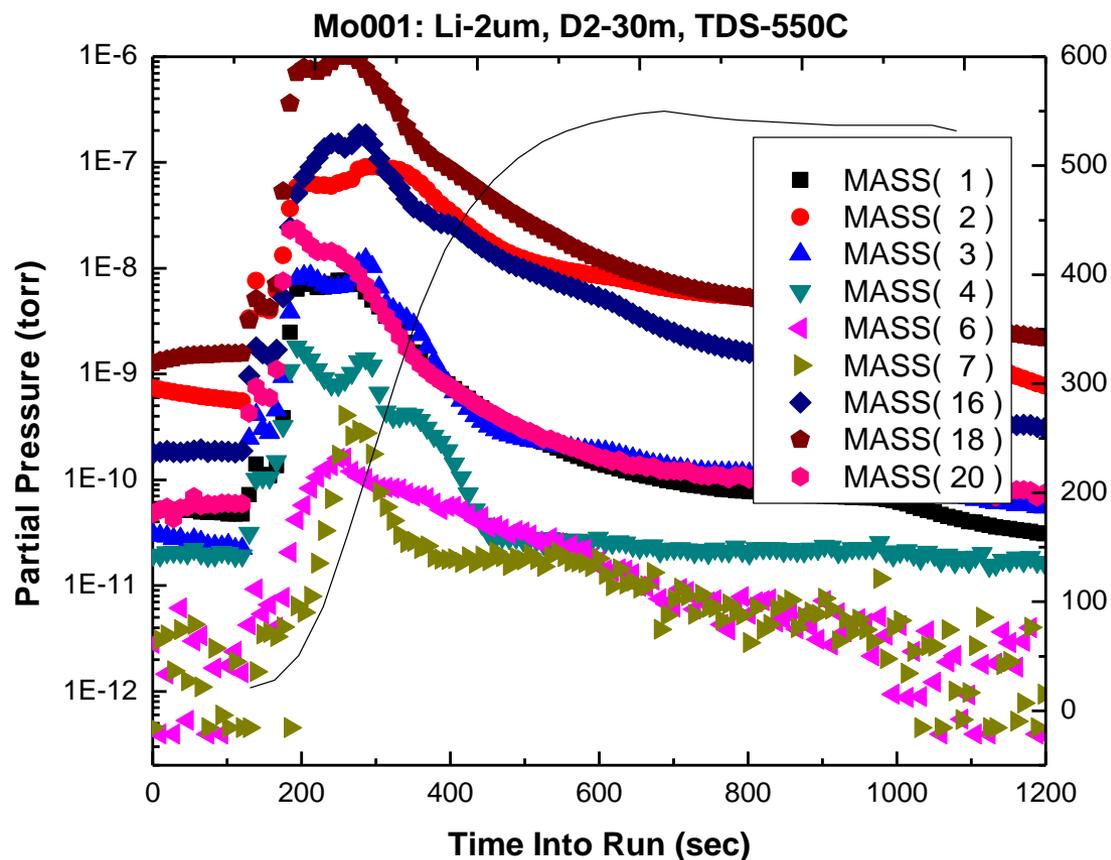
- Virgin sample
  - PPI
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS
- 15 min  $\text{D}_2$  irradiation
  - XPS (not shown)
- 15 min  $\text{D}_2$  irradiation (30min cumulative)
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS



# Moly with Li and D, no temperature

## Mo001

- Virgin sample
  - PPI
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS
- 15 min  $\text{D}_2$  irradiation
  - XPS (not shown)
- 15 min  $\text{D}_2$  irradiation (30min cumulative)
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

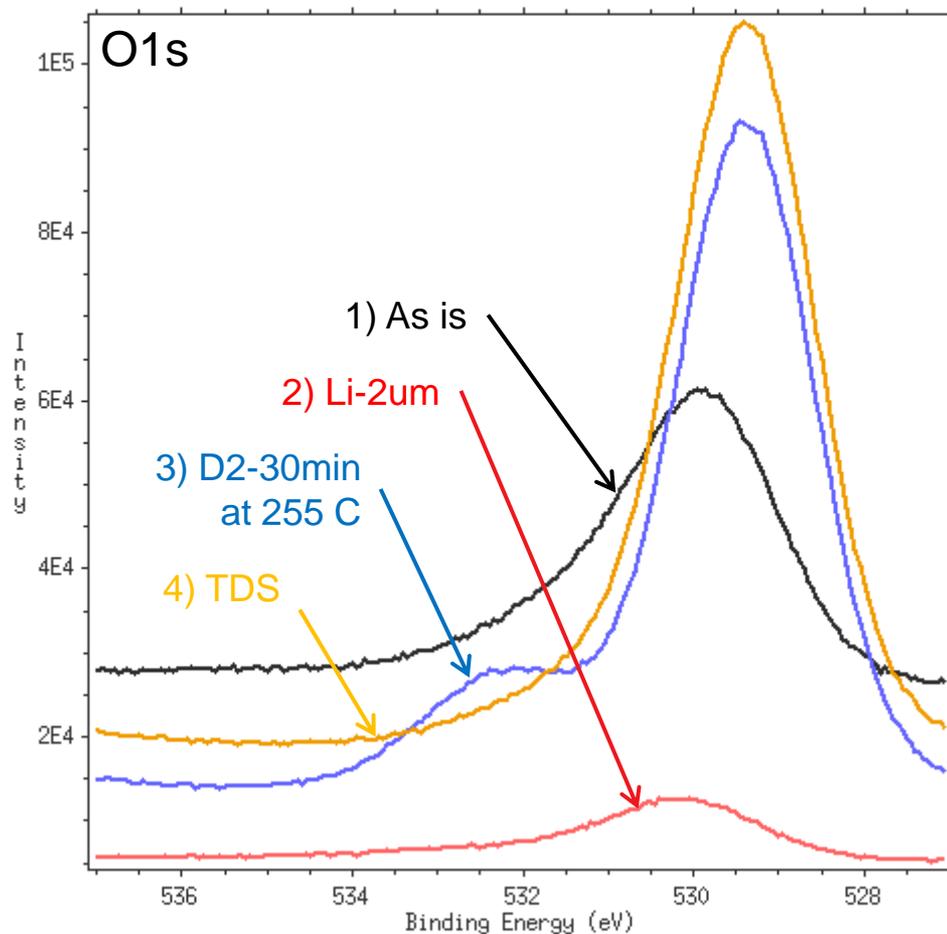


# D irradiation on hot Mo-Li (2 $\mu\text{m}$ )

## Mo002

- Virgin sample
  - PPI
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - RGA during dep.
  - XPS following dep.
- Heated to 255 C
  - RGA data recorded
  - Melting after 6 min. at 250 C
  - 30 min D<sub>2</sub> irradi. began 14 min into heating
  - XPS
- TDS at 550 C
  - Li started as solid
  - RGA data recorded
  - XPS

black :: Date= 100223; Sample= Mo002; Comment= As is scan  
red :: Date= 100223; Sample= Mo002; Comment= Li-2um  
blue :: Date= 100223; Sample= Mo002; Comment= Li-2um, D2-30m at 255C  
orange :: Date= 100228; Sample= Mo002; Comment= Li-2um, D2-30m at 255C, wait 5d, TDS (!)

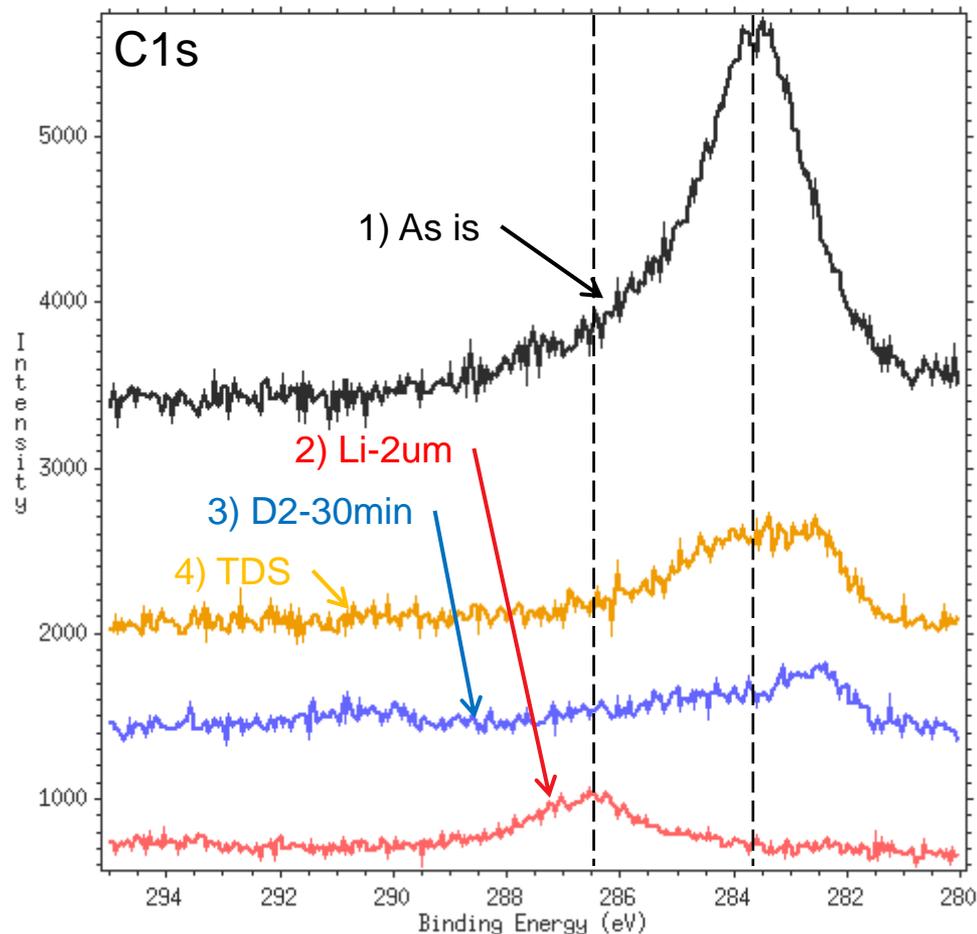


# D irradiation on hot Mo-Li (2 $\mu\text{m}$ )

## Mo002

- Virgin sample
  - PPI
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - RGA during dep.
  - XPS following dep.
- Heated to 255 C
  - RGA data recorded
  - Melting after 6 min. at 250 C
  - 30 min D<sub>2</sub> irradi. began 14 min into heating
  - XPS
- TDS at 550 C
  - Li started as solid
  - RGA data recorded
  - XPS

black :: Date= 100223; Sample= Mo002; Comment= As is scan  
red :: Date= 100223; Sample= Mo002; Comment= Li-2um  
blue :: Date= 100223; Sample= Mo002; Comment= Li-2um, D2-30m at 255C  
orange :: Date= 100228; Sample= Mo002; Comment= Li-2um, D2-30m at 255C, wait 5d, TDS (

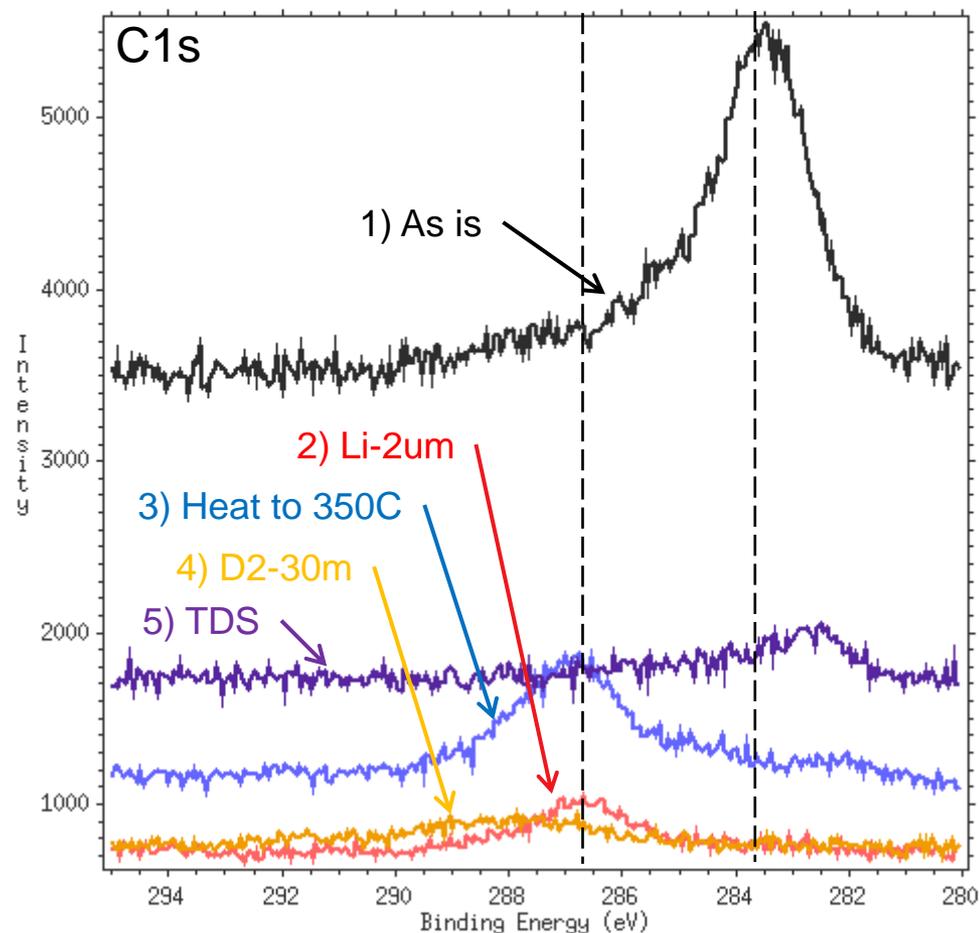


# Melt Li, let it cool and then D-irradiate

## Mo101

- Virgin sample
  - PPI acid clean
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS following dep.
- Heated to 360 C
  - RGA data recorded
  - Melting after 6 min. at 210 C (*video-not included*)
  - Wait 1 day
- 30 min  $\text{D}_2$  irradiad.
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

```
black :: Date= 100401; Sample= Mo101; Comment= As is scan
red :: Date= 100401; Sample= Mo101; Comment= Li-2um
blue :: Date= 100401; Sample= Mo101; Comment= Li-2um, (350 Deg C)
orange :: Date= 100403; Sample= Mo101; Comment= Li-2um, (350 C), w-1d, D2-30m
>le :: Date= 100406; Sample= Mo101; Comment= Li-2um, (350 Deg C), w-1d, D2-30m,w-3d, T1
```

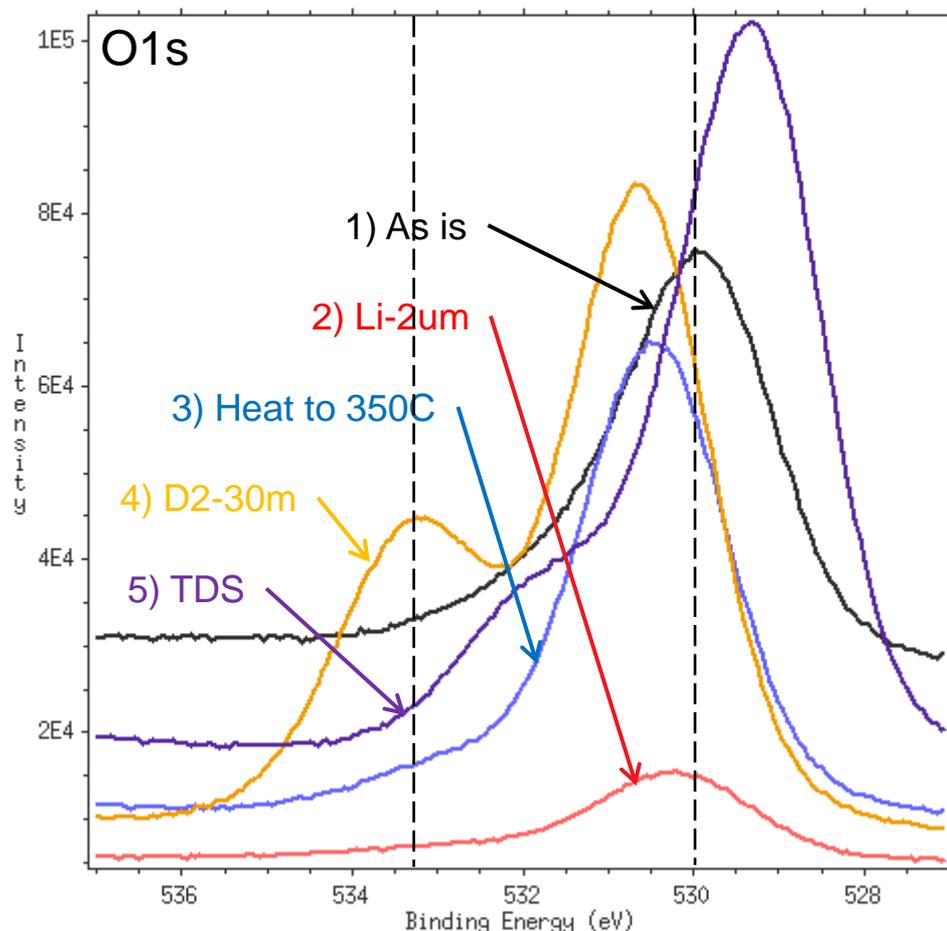


# Melt Li, let it cool and then D-irradiate

## Mo101

- Virgin sample
  - PPI acid clean
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS following dep.
- Heated to 360 C
  - RGA data recorded
  - Melting after 6 min. at 210 C (*video-not included*)
  - Wait 1 day
- 30 min  $\text{D}_2$  irradiad.
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

black :: Date= 100401; Sample= Mo101; Comment= As is scan  
red :: Date= 100401; Sample= Mo101; Comment= Li-2um  
blue :: Date= 100401; Sample= Mo101; Comment= Li-2um, (350 Deg C)  
orange :: Date= 100403; Sample= Mo101; Comment= Li-2um, (350 C), w-1d, D2-30m  
ple :: Date= 100406; Sample= Mo101; Comment= Li-2um, (350 Deg C), w-1d, D2-30m,w-3d, T1

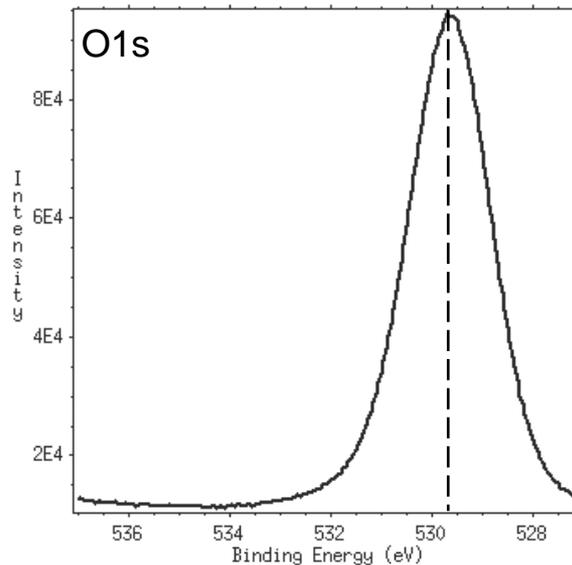


# Control sample – Heating Li with no D

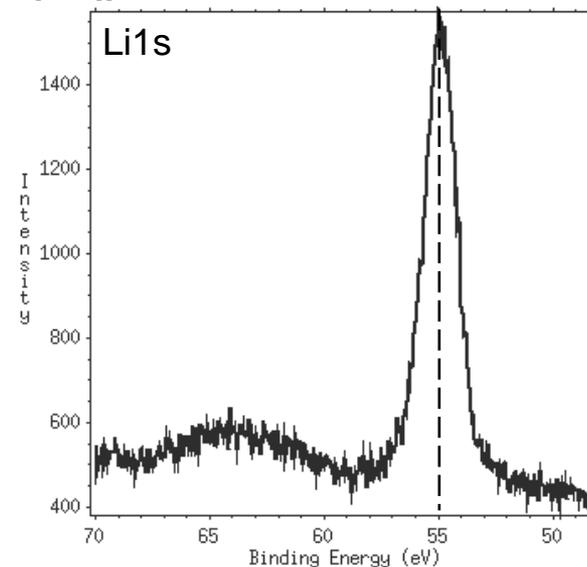
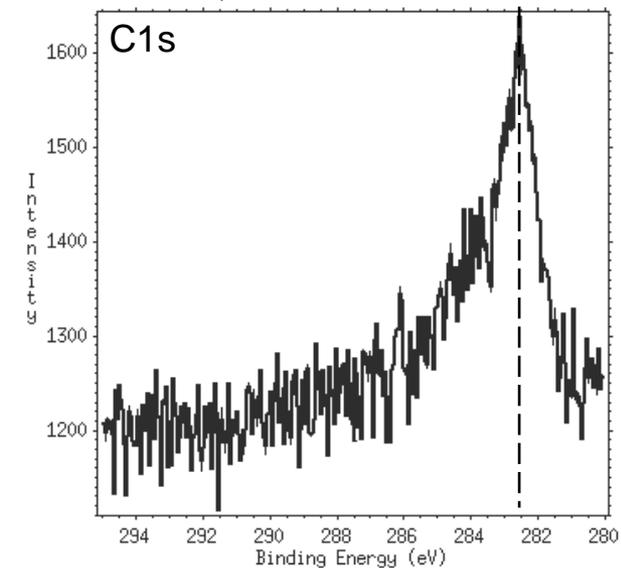
## Mo201

- Virgin sample
  - PPI
- 5  $\mu\text{m}$  Li deposition
  - RGA data taken
  - Detailed video
- TDS at 550 C
  - XPS

Date= 100406; Sample= Mo201; Comment= Post Li-5u TDS (550 C)



Date= 100406; Sample= Mo201; Comment= Post Li-5u TDS (550 C)



# Melt Li, let it cool and then D-irradiate

## Mo101

- Virgin sample
  - PPI acid clean
  - XPS
- 2  $\mu\text{m}$  Li deposition
  - XPS following dep.
- Heated to 360 C
  - RGA data recorded
  - Melting after 6 min. at 210 C (*video-not included*)
  - Wait 1 day
- 30 min D<sub>2</sub> irradiation
  - XPS
- TDS at 550 C
  - RGA data recorded
  - XPS

