**MOX with water**

**PK: preparation chamber**

**AK: analysis chamber**

**ov: overview**

**RT: room temperature**

**15/01/2013**

Sputtering source is equipped with Pu and Uranium. Pu is sputtered all the time, but there is often a short cut. That is why we are now starting with uranium. There will probably be a more or less strong cross contamination of the uranium.

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

60s 3.5V/2.9A 30/8A --- 700V/1.0mA 1.3e-6 ---

001 HeII

002 HeI

003 ov

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

60s 4.2V/3.2A 30/24A --- 700V/1.0mA 1.9e-7 6e-7

004 HeII

005 HeI

006 ov

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

120s 4.2V/3.3A 30/20A --- 700V/1.1mA 2.1e-7 5e-7

007 HeII

008 HeI

009 ov

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

60s 4.2V/3.3A 30/20A --- 700V/1.1mA 9.4e-7

010 ov

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

120s 4.2V/3.3A 50/12A --- 700V/1.5mA 4.5e-7

011 ov now you can see some uranium!

012 HeII

013 HeI

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

120s 4.4V/3.5A 50/16A 50V/0.5mA 700V/1.1mA 2.6e-7 5e-7

014 HeII

015 HeI

016 ov

017 u4fpu4f

018 o1s

Sample heated to 100°C and 100sec. exposed to oxygen at 5E-7 ( ~50 Langmuir )

019 u4fpu4f now you can clearly see the satellites at Pu!

020 ov

021 HeII

022 HeI

+5.0\*10-6 mbar H2O (180sec), at -177C (~8.5mV) (valve: scale 0.5)

UV source: 22.8A; 83-85V

023 HeII -155°C (7.5mV) 16:12

024 HeI -134°C (7.1mV) 16:15

025 HeII -125°C (6.9mV) 16:18

026 HeII -121°C (6.7mV) 16:21

027 HeII -87°C (5.6mV) 16:25

From -74°C you could see water on the RGA. But unfortunately very little...

028 HeII -45°C (3.5mV) 16:31

029 HeI -42°C (3.4mV) 16:34

030 HeII -32°C (3.0mV) 16:42

The helium valve on the UV source has to be turned on more and more in order for the source to ignite and work. It used to be scale: 1.5 now we are over scale: 2.....

Unfortunately, the pressure gauge does not work to determine whether

**16/01/2013**

031 HeII film from yesterday

+9.0\*10-6 mbar H2O (180sec), at -134 (~7.2mV) (valve: scale 0.8)

Probably not cold enough to deposit H2O...

UV source: 22.8A; 83-85V

032 HeII -132°C 9:04

033 HeI

034 HeII -117°C 9:09

035 HeI -87°C 9:18

036 HeII -84°C 9:21

037 HeI -89°C 9:23

038 HeII -81°C 9:26

039 HeI -76°C 9:34

040 HeII -72°C 9:36

041 HeII -36°C 9:42

042 HeII -6°C 10:06

043 HeII -1°C 10:17

044 HeII +7°C 10:38

045 HeII +15°C 11:16 sample looks somehow different than before….

Briefly heated up to 100°C

046 HeII +63°C 11:36

Heated again to 100°C for 10 minutes. 11:45

047 HeI +100°C 11:48

048 HeII +99°C 11:55

lunch break

049 HeII +29°C 13:11

050 ov

051 u4fpu4f

052 o1s

**17/01/2013**

053 HeII RodPos: 500 old film from yesterday

The film now looks like it did at the beginning of the water experiment

054 HeII RodPos:0 Sample shifted by 500 steps to check whether the film looks the same

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

120s 4.3V/3.4A 56/10A 20V/0.2mA 700V/1.8mA 6.1e-7 5e-7

055 HeII

056 HeI

Sample heated to 100°C and 100sec. at 5.6E-7 exposed to oxygen ( ~50 Langmuir )

057 HeII

058 HeI

059 ov

060 u4fpu4f Ratio U/Pu 55%/45% (excluding oxygen)

061 o1s Ratio U/Pu/O = 22%/18%/60%

+1.0\*10-5 mbar H2O (180sec), at -182°C (valve: scale 0.9)

062 HeII -165°C 14:39

063 HeI -131°C 14:48

064 HeII -128°C 14:50

065 HeI -125°C 14:53

066 HeII -122°C 14:56

067 HeI -96°C 15:00

068 HeII -90°C 15:03

069 HeI -104 15:08 The UV source often goes out again.

070 HeII -93 15:13

071 HeI -76 15:17

072 HeII -73 15:18

073 HeI -71 15:24

074 HeII -68 15.26

075 HeI -66 15:30

rod moved from pos:500 to pos:0

076 HeII -64 15:32 you can see a clear difference !!!!

077 HeI -59 15:37

Rod moved back to Pos:500

078 HeII -55 15:39

079 HeI -48 15:43

080 ov

081 u4fpu4f looks strange, will be measured again.

082 o1s

083 u4fpu4f

**18/01/2013**

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

120s 4.5V/3.5A 50/12A --- 700V/1.5mA 5.1e-7 1e-6

084 HeII

085 HeI

086 ov

087 u4fpu4f only 300sec. measurement time. Same U/PU ratio as film before

Ratio U/Pu 64%/36% (excluding oxygen)

088 o1s Ratio U/Pu/O = 18%/10%/72%

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

180s 4.5V/3.5A 50/15A short cut 700V/1.5mA 5.2e-7 9e-7

089 HeII

090 HeI

091 ov

092 u4fpu4f unfortunately there is not enough oxygen on the film, will continue on Monday.

093 o1s

**21/01/2013**

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

180s 4.5V/3.5A 50/12A short cut 700V/1.5mA 6.3e-7 1.3e-6

094 HeII

095 HeI

096 ov

097 u4fpu4f Ratio U/Pu = 77%/23% = 3.3 / 1

098 o1s

+1.0\*10-5 mbar H2O (180sec), at -150°C (valve: scale 0.9)

UV source: 23A/77V

099 HeII -136°C 10:45

100 HeI -124°C 10.48

101 HeII -118°C 10:51

102 HeI -113 10:55

103 HeII -113 10:57

104 HeII - 111 11:00

105 HeII -109 11:02 UV source went out shortly before the end

105a HeII -107 11:07

106 HeI -99 11:09 Something N2 came.

107 HeII -55 11:13 Now comes H2O

108 HeI -36 11:15

109 HeII -28 11:17

110 HeI -18 11:21

111 HeII -14 11:23

112 HeI -10 11:26

113 HeII -8 11:28 Rod moved 500 steps (RodPos:0) DIFFERENCE

114 HeI -5 11:32

115 HeII -3 11:35 back to RodPos: 500

116 HeI -1 11:38

117 ov

118 u4fpu4f

119 o1s

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

180s 4.8V/3.6A 50/20A short cut 700V/1.7mA 3.8e-7 1.3e-6

120 HeII

121 HeI

122 ov

123 u4fpu4f

124 o1s

Not enough oxygen on sample area

Sample heated to 100°C and 100sec. exposed to oxygen at 5.1E-7 ( ~50 Langmuir )

125 u4fpu4f ~60°C Ratio U/Pu 81%/19%

126 HeII

+1.0\*10-5 mbar H2O (180sec), at -143°C (valve: scale 0.9)

UV source: 23A/77V

127 HeII -140°C 15:48

128 HeI -118 15:51

129 HeII -116 15:53

130 HeI -118 15:56

131 HeII -104 15:59

132 HeI -74 16:01

The H2O came at -66°C. Pressure in AK increased from 1.4e-8 to 3.2e-8

133 HeII -58 16:04

134 HeI -37 16:07

135 HeII -29 16:08

136 HeI -15 16:13

137 HeII -15 16:15

138 HeI -13 16:18

139 HeII 0 16:20 helped with heating so that it goes faster to RT….

140 HeI 0 16:23

141 HeII 15 16:25

142 HeI 15 16:29

143 HeII 25 16:31

144 HeI 25 16:34

145 u4fpu4f

146 o1s

147 ov

**22/01/2013**

148 HeI old film from yesterday

149 HeII

150 pu4f

Sample heated to 100°C and 50sec. exposed to oxygen at 5.7E-7 ( ~25 Langmuir )

151 HeII

152 HeI

153 u4fpu4f

Will now cool down the film and warm it up with the UV source switched on to prove that the effect only works in the presence of water!

154 HeII -149°C 10:00

155 HeI -145 10:03

156 HeII -140 10:05

157 HeI -130 10:08

158 HeII -119 10:10

159 HeI -93 10:13

160 HeII -80 10:15

161 HeI -37 10:25

162 HeII -31 10:27 NO EFFECT to be seen, as expected!!

+1.0\*10-5 mbar H2O (180sec), at -148°C (valve: scale 0.9)

163 HeII -136°C 10:51

164 HeI -113 10:54

165 HeII -108 10:57

166 HeI -102 11:01

167 HeII -101 11:04

168 HeI -101 11:07

169 HeII -97 11:10

At -90°C comes mass: 44 with RGA

170 HeI -83 11:13

171 HeII -70 11:15

At -62°C the water starts to evaporate...

172 HeI -59 11:17

173 HeII -56 11:20

174 HeI -47 11:24

175 HeII -32 11:26

176 HeI -31 11:27

Sample returned to PK cooled down for oxygen exposure.

Unfortunately I turned on the water valve...

Back to AK to check

177 HeII -30 (heating on to get water away) Sample partially oxidized again

178 HeI -58 (heating off)

Leave in AK for 2 hours at -30°C

179 HeII -30°C

180 HeII +100°C

Sample at 100°C and 50sec. at 5.0E-7 exposed to oxygen ( ~25 Langmuir )

181 HeII +92

182 HeI +75

+1.0\*10-5 mbar H2O (180sec), at -157°C (valve: scale 0.9)

UV source 23A/73.5V

183 HeII -143°C 15:31

184 HeI -120 15:34

185 HeII -115 15:36

186 HeI -111 15:39

187 HeII -106 15:41

188 HeI -96 15:44 RGA Mass:28

189 HeII -90 15:45

190 HeI -80 15:47

At -70°C RGA mass: 18

191 HeII -70 15:50

192 HeI -60 15:55

193 HeII -60 15:56

194 HeI -40 16:05 source keeps going out…. Effect there, cool down again

Sample in PK: 5.7E-7 exposed to oxygen for 50sec. ( ~25 Langmuir ) -95°C

195 HeII -96 16:11

196 HeI -92 16:13

Sample in PK: 5.7E-7 exposed to oxygen for 100sec. ( ~50 Langmuir ) at -100°C

197 HeII -100 16:18

198 HeI -98 16:21

199 HeII -94 16:26

200 HeI -93 16:29

**24/01/2013**

201 HeII old film from the day before yesterday

Test on RT, 60sec. at 1.2E-7 exposed to oxygen in AK!!!! ( ~6 Langmuir )

202 HeII works like this, I can take the film

203 HeI

+1.0\*10-5 mbar H2O (180sec), at -157°C (valve: scale 0.9)

204 HeII -165°C 10:23

205 HeI -135° 10:27

206 HeII -127 10:29

207 HeI -117 10:33

208 HeII -114 10:35

209 HeI -101 10:38

210 HeII -96 10:41

211 HeI -91 10:44

212 HeII -80 10:48

213 HeI -70 10:54

214 HeII -55 10:59

215 HeI -55 11:03

216 HeII -30 11:05

217 HeI -30 11:08

Sample at -30°C, 60sec. at 5.4E-7 exposed to oxygen in AK!!!! ( ~30 Langmuir )

218 HeII -30 11:17

219 HeI -30 11:20

**28/01/2013**

UV source: Filament changed. Chamber and filament baked out.

Source is unfortunately very unstable! Pump out the helium line again.

220 HeII source runs at 21.5A/71V

Sputter cleaning: 5e-5mbar(PK) 60sec. at 2.5kV

221 HeII UV source: 21.5A/73V

222 HeII UV source: 23A/69V

Sample on RT, 30sec. at 5.4E-7 exposed to oxygen in AK!!!! ( ~x Langmuir )

223 HeII UV source: 21.3/70.3V

224 HeI

225 HeII UV source: 21.3/73.0V

226 HeI

+1.0\*10-5 mbar H2O (180sec), at -178°C up to -165°C (valve: scale 0.9) 16:12

Sample for 20 min at -160°C >> UV source on, then UV source switched off, warmed up to -30°C and then UV source switched on

UV source operated at 21.1A/74.5V, have slightly lower settings so that it doesn't go out all the time....

227 HeII -154°C 16:16

228 HeI -152 16:19

229 HeII -149 16:21

230 HeI -145 16:25

231 HeII -142 16:27

232 HeI -134 16:31

233 HeII - 127 16:33

234 HeI - 123 16:36

UV source off, N2 to >> warm up to -30°C 16:37

I warm up and help out a bit with the heating, water comes out at -70°C...

235 HeII -30 16:47 Aaarrrgghh, source keeps going out...

Oh man, I can't get any more measurements, the source keeps going out...

235a HeII -20 16:56 UV source: 22A/62.76V

236 HeI- 18 16:59

237 HeII -12 17:03 UV source: 20.9A/79.0V

238 heI -11 17:06

**29/01/2013**

239 HeII old film from yesterday

240 HeI

Test on RT, 60sec. at 5.2E-7 exposed to oxygen in AK!!!! ( ~30 Langmuir )

241 HeII

242 HeI

+1.0\*10-5 mbar H2O (60sec), at -173°C up to -168°C (valve: scale 0.9) 9:47

**Only a third of the water deposited as before!!**

243 HeII -163°C 9:48 UV source went out during measurement..

243a HeII -147 9:51

244 HeI - 139 9:54

245 HeII -135 9:56 source went out again towards the end

246 HeI - 130 9:59

247 HeII - 120 10:01

248 HeI - 110 10:05

249 HeII -104 10:06

250 HeI - 71 10:20

251 HeII - 64 10:22

252 HeI - 58 10:25

253 HeII - 30 10:27

254 HeI - 26 10:31

Sample 0°C, 60sec. at 1.2E-7 exposed to oxygen in AK!!!! ( ~6 Langmuir )

255 HeII 2°C

256 HeI

+1.0\*10-5 mbar H2O (30sec), at -173°C up to -168°C (valve: scale 0.9) 11:18

**Only a sixth of the water deposited as before!!**

257 HeII -155°C 11:19

258 HeI -140 11:22

259 HeII -133 11:24

260 HeI -123 11:28

261 HeII -120 11:30

262 HeI -115 11:34

263 HeII -117 11:36

264 HeI -113 11:40

265 HeII -90 11:41

266 HeI -85 11:44

267 HeII -60 11:47

268 HeI -56 11:50

269 HeII -28 11:56

270 HeI -24 11:59

Oxisorb to He line. exchanged. Pumped out the line over noon….

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

180s 4.8V/3.6A 50/20A short cut 700V/2.0mA 6.4e-7 2.0e-6

271 HeII

272 HeI

273 ov

274 u4fpu4f Ratio U/Pu 79%/21%

275 o1s

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

300s 4.7/3.5A 50/16A short cut 700V/1.6mA 7.8e-7 2.0e-6

276 u4fpu4f Ratio U/Pu 89%/11%

277 o1s

278 ov

279 HeII

280 HeI

**30/01/2013**

281 HeII old film from yesterday.

282 HeI

Sample 28°C, 60sec. at 1.1E-7 exposed to oxygen in AK!!!! ( ~6 Langmuir )

283 HeII source wag g end briefly. Sparkling wine can still be used!

284 HeI

+1.0\*10-5 mbar H2O (180sec), at -165°C up to -147°C (valve: scale 0.9) 10:20

285 HeII -142°C 10:24

286 HeI - 125 10:27

287 HeII -117 10:29

288 HeI -109 10:32

289 HeII - 107 10:34

290 HeI -103 10:39

291 HeII -101 10:42

292 HeI -100 10:45

293 HeII -90 10:48

294 HeI -88 10:52

At about 85°C the water starts to evaporate.

295 HeII -82 10:55

296 HeI -73 10:59

297 HeII -59 11:01 ATTENTION: source went out again towards the end….

298 HeI -29 11:12

299 HeII -19 11:14 Source in the middle briefly from...

300 HeII +27 15:03

301 HeI +27 15:07

**04/02/2013**

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

300sec 4.8/3.6 59V/10A short cut 700V/1.6mA 8.4e-7 2.0e-6

302 u4fpu4f Ratio U/Pu 97%/3%

303 o1s

304 ov

305 HeII

306 HeI

Sample 28°C, 60sec. at 1.1E-7 exposed to oxygen in AK!!!! ( ~6 Langmuir )

307 HeII

308 HeI

**05/02/2013**

309 HeII film from yesterday

310 HeI

**06/02/2013**

311 HeII film from yesterday

312 HeI

+1.0\*10-5 mbar H2O (180sec), at -167°C up to -157°C (valve: scale 0.9) 10:57

UV source: 21A/70V

313 HeII -155°C 11:00

314 HeI -135 11:03

315 HeII -117 11:09

316 HeI -113 11:12

317 HeII -107 11:17

318 HeI -105 11:21

319 HeII -103 11:23

320 HeI -101 11:28

321 HeII -103 11:33

322 HeI -90 11:35

323 HeII -59 11:39 now the water is coming….

324 HeI -49 11:42

325 HeII -30 11:47

326 HeI -20 11:50

327 HeII - 0 12:01

328 HeII +1 12:04 RodPos:0

329 HeI 0 12:10 \_

Rod moved back to RodPos.500 (only after 1000 then to 500 so that the pos is always approached from one direction)

330 HeII 0 12:12

331 HeI 0 12:15

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

300sec. 4.9V/3.6A 59V/10A short cut 700V/1.4mA 6.3e -7 2.0e-6

332 u4fpu4f Ratio U/Pu 97%/3%

333 o1s

334 ov

335 HeII strange, the UO2 seems to be reduced….

336 HeII

Sample 25°C, 60sec. at 1.2E-7 exposed to oxygen in AK!!!! ( ~6 Langmuir )

337 HeII

338 HeI

**07/02/2013**

Sample 26°C, 100sec. at 1.0E-6 exposed to oxygen in PK!!!! ( ~100 Langmuir )

339 HeII

340 HeI

341 HeII 3h later

341 HeI

343 HeII RodPos: 0

+1.0\*10-5 mbar H2O (180sec), at -176°C up to -167°C (valve: scale 0.9) 15:35

UV source: 21A/70V

344 HeII -155°C 15:38

345 HeI -143 15:41

346 HeII -132 15:44

347 HeI- -122 15:48

348 HeII -117 15:52

349 HeI -114 15.55

350 HeII -112 15:58

351 HeI -107 16:01

352 HeII -90 16:04

353 HeI -80 16:06

354 HeII -70 16:09

355 HeI -60 16:13

356 HeII -46 16:17

357 HeI -30 16:20

358 HeII -20 16:22

359 HeI 0 16:27

360 HeII 12 16:30

361 HeI 11 16:33

362 HeII 11 16:35 RodPos:0

363 HeI 11 16:37

**07/02/2013**

364 HeII 11 16:35 RodPos:500

365 HeI

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

300sec. 4.8V/3.6A 60V/11A short cut 700V/1.7mA 8.8e-7 3.0e-6

366 uf4pu4f

367 o1s

368 ov

369 HeII

370 HeI

**20/02/2013**

**Dep[s] Fil. Work Pu (Targ.2) U (Targ.1) Ar O2**

300sec. 5.0V/3.7A 65V/10A short cut 700V/1.3mA 6.3e-7 3.0e-6

371 uf4pu4f

372 o1s

373 ov

374 HeII

375 HeI

+1.0\*10-5 mbar H2O (180sec), at -175°C up to -171°C (valve: scale 0.9) 10:23

UV source: 22A/64.4V

RodPos:500

376 HeII -158°C 10:27

377 HeI -113 10:36

378 HeII -109 10:39

379 HeI -106 10:42

380 HeII -104 10:44

381 HeI -100 10:48 RGA: N2 coming

382 HeII -80 10:50

383 HeI -65 10:53

384 HeII -50 10:55

385 HeI -35 10:58

386 HeII -25 11:00

387 HeI -20 11:03

388 HeII -20 11:05 RodPos :0

389 HeI -20 11:08 RodPos:0

390 HeII -20 11:10 back to RodPos:500

391 HeI -10 11:13

392 HeII 0 11:16

393 HeI +24 11:20