CEA:

Raman, SEM, and CLSM characterization of selected Be and W reference samples

C. Pardanaud, G. Giacometti, C. Martin

PIIM
Physique des Interactions Ioniques et Moléculaires

cnrs
dépasser les frontières

Aix*Marseille université

Be/D RT→ 500°C

Raman spectra of heat treated Be/D → couple with TDS to investigate TDS peaks origins

Diamond & Related Materials 34 (2013) 100–104

Contents lists available at SciVerse ScienceDirect

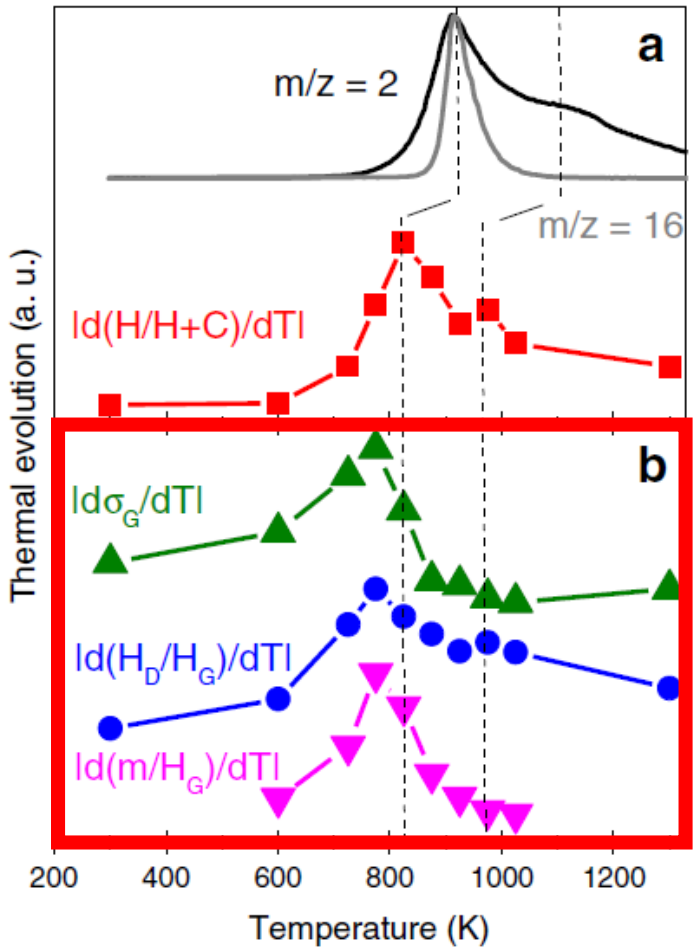
Diamond & Related Materials

journal homepage: www.elsevier.com/locate/diamond

Raman spectroscopy investigation of the H content of heated hard amorphous carbon layers

C. Pardanaud [a,*], C. Martin [a], P. Roubin [a], G. Giacometti [a], C. Hopf [b], T. Schwarz-Selinger [b], W. Jacob [b]

H-**C**(sp^3) H-**C**(sp^2)



← TDS

← Ion beam analyses **derivative**

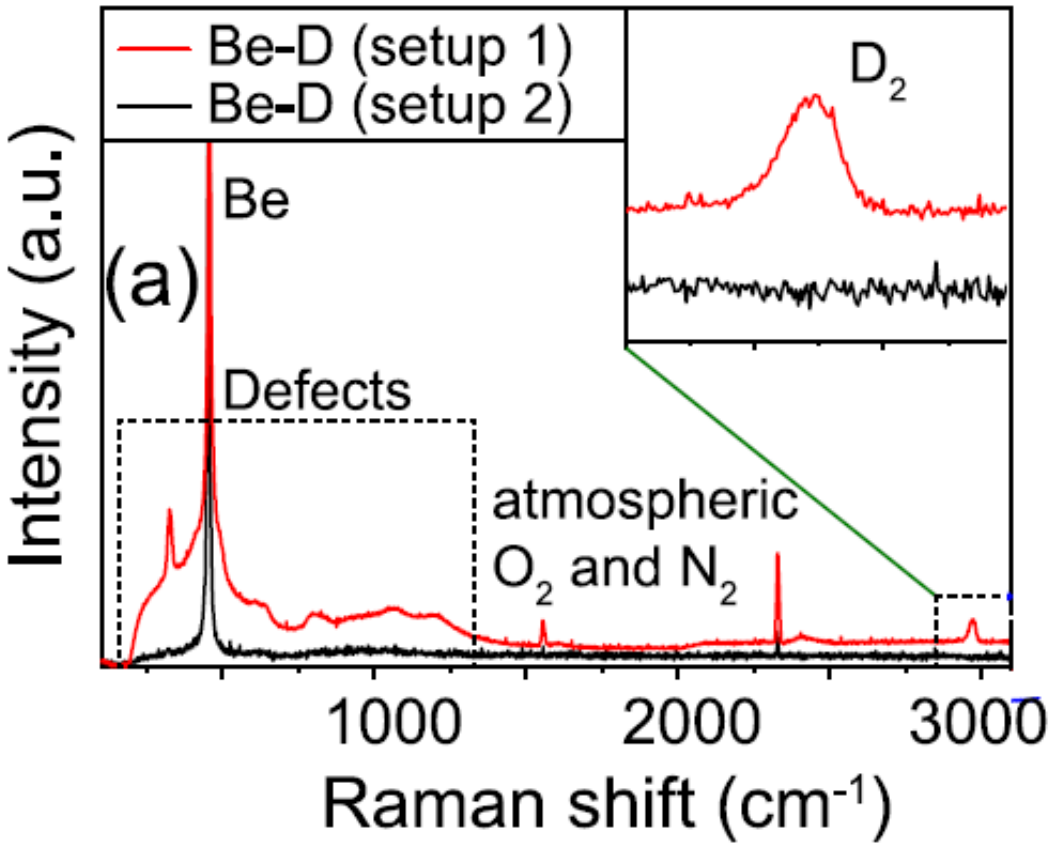
Raman parameter **derivative**

IOP Publishing | Royal Swedish Academy of Sciences Physica Scripta
Phys. Scr. T171 (2020) 014038 (8pp) https://doi.org/10.1088/1402-4896/ab4be8

Effect of composition and surface characteristics on fuel retention in beryllium-containing co-deposited layers

Antti Hakola[1], Kalle Heinola[2,3], Kenichiro Mizohata[3], Jari Likonen[1], Cristian Lungu[4], Corneliu Porosnicu[4], Eduardo Alves[5], Rodrigo Mateus[5], Iva Bogdanovic Radovic[6], Zdravko Siketic[6], Vincenc Nemanic[7], Mohit Kumar[8], Cedric Pardanaud[8], Pascale Roubin[8] and EUROfusion WP PFC Contributors[9]

- D_2 detection in « **high** » amount of BeD samples
- « **high** » = 20% of at. D



IOP Publishing Phys. Scr. 96 (2021) 124031 Physica Scripta https://doi.org/10.1088/1402-4896/ac267b

PAPER

D retention and material defects probed using Raman microscopy in JET limiter samples and beryllium-based synthesized samples

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29 July 2021

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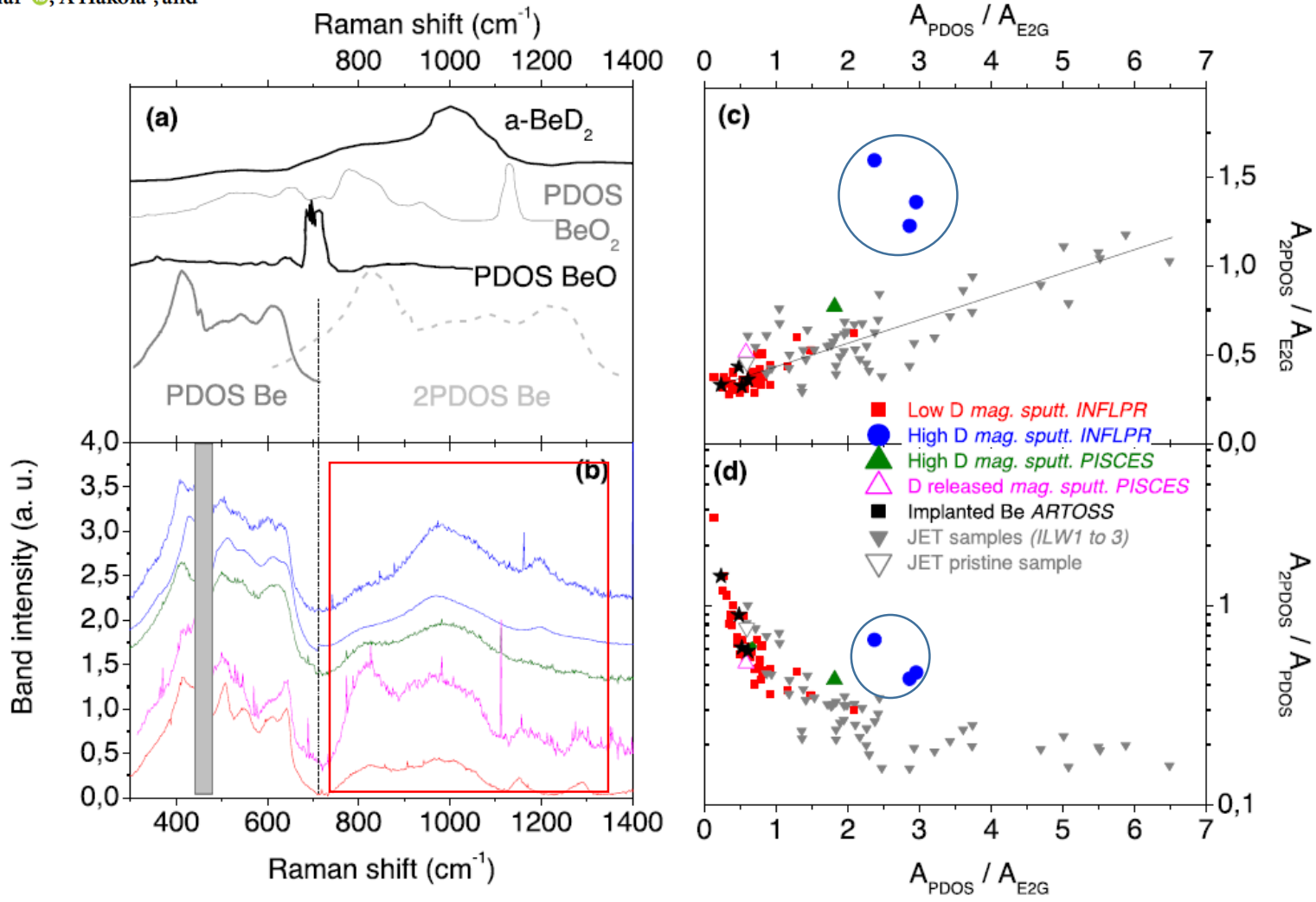
27 September 2021

C Pardanaud[1], M Kumar[1], P Roubin[1], C Martin[1], Y Ferro[1], J Denis[1], A Widdowson[2], D Douai[3], M J Baldwin[4], A Založnik[4], C Lungu[5], C Porosnicu[5], P Dinca[5], T Dittmar[5], A Hakola[7], and EUROfusion WP PFC contributors[8] JET contributors[9]

- Detection of amorphous BeD_2
- Spectral confusion with another signature

→ Need to use isotopical shift (i.e. use H)

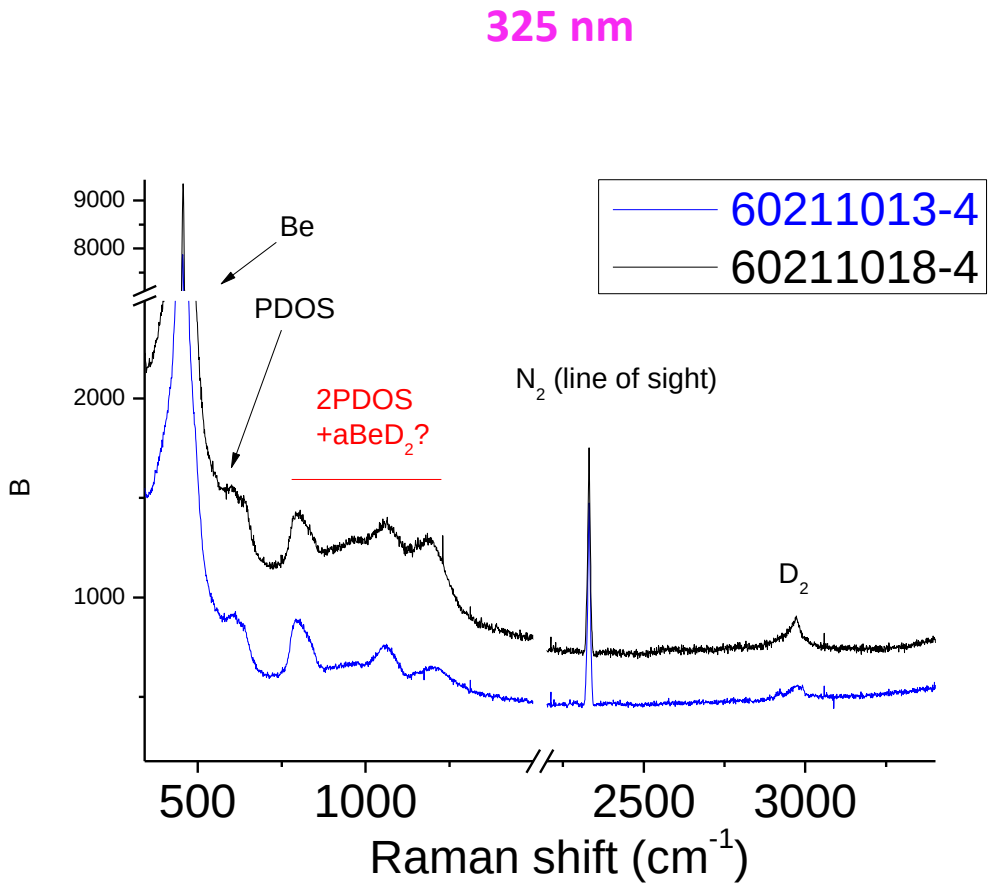


Be/D RT→ 500°C **Be/H RT→500°C**

Isotopic effect→ shift the aBeH_2 signature away from 2PDOS

Be/D RT→ 500°C Be/H RT→500°C

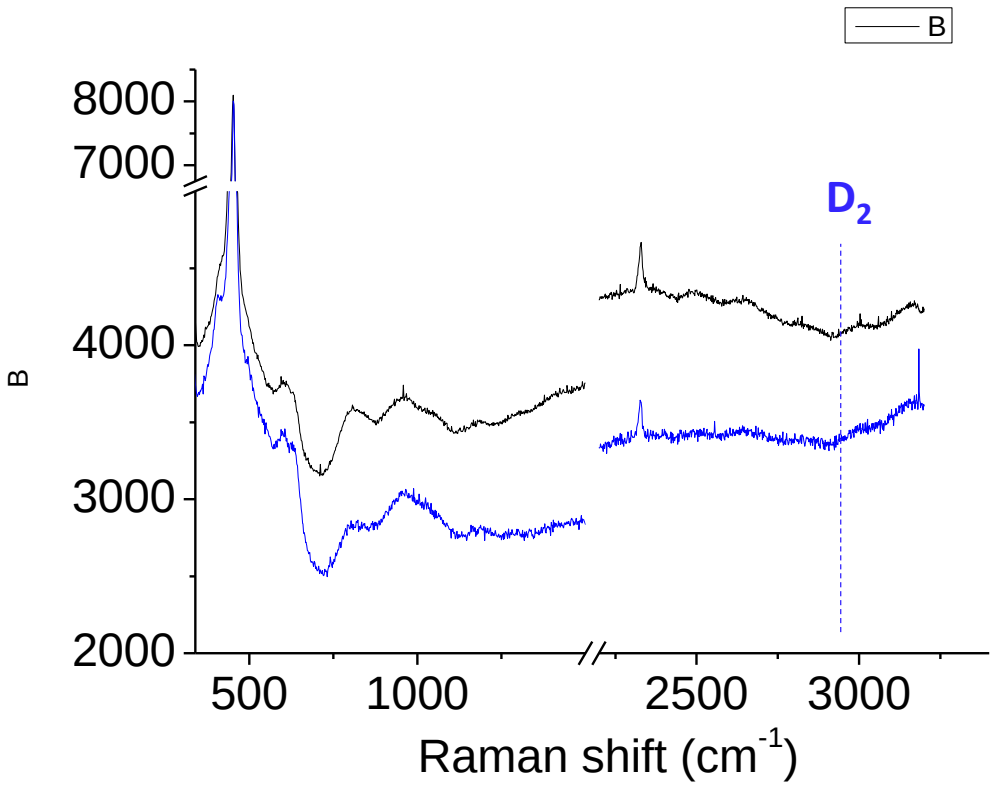
Nov 2021: *decide the experimental conditions for producing the thermal series*



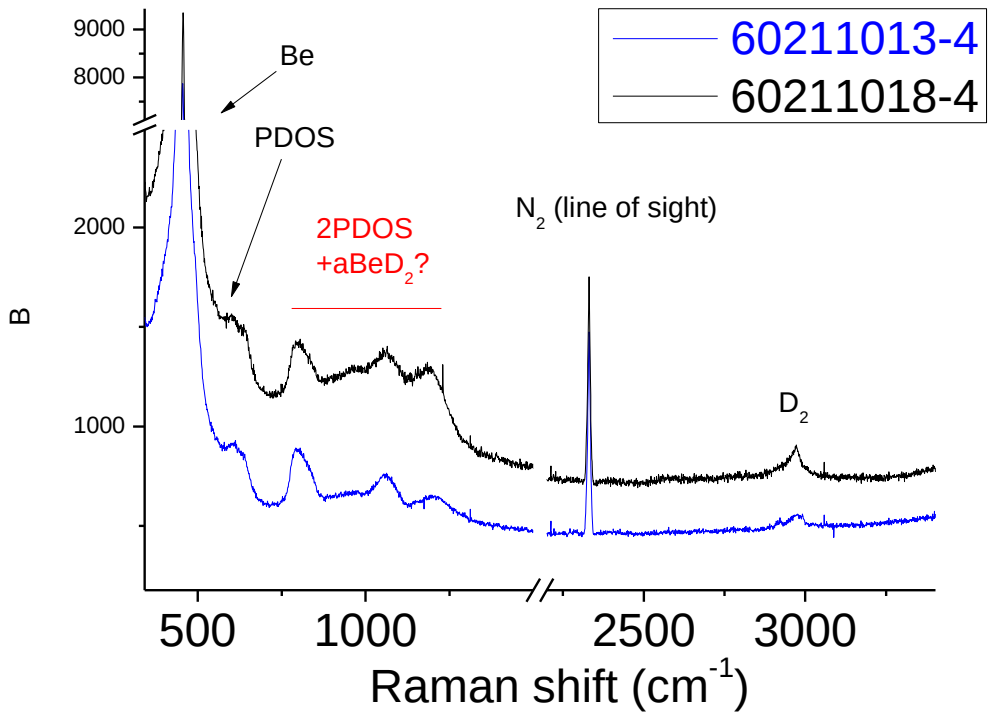
Be/D RT→ 500°C Be/H RT→500°C

Nov 2021: *decide the experimental conditions for producing the thermal series*

514 nm



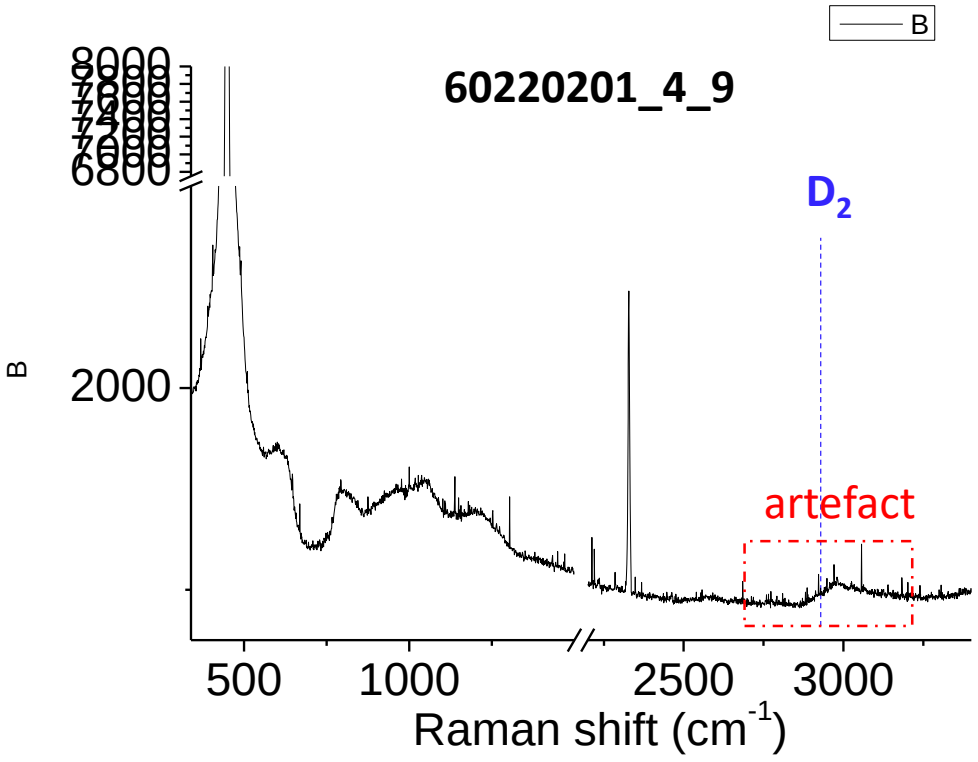
325 nm



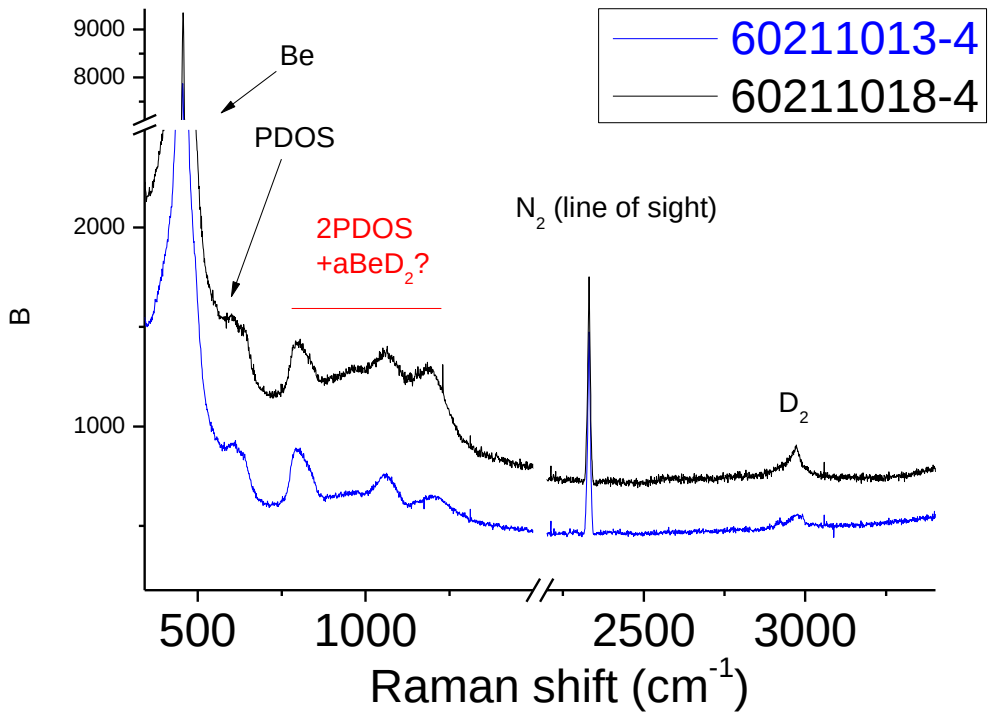
Be/D RT→ 500°C Be/H RT→500°C

End of march 2022: *start acquisition*

325 nm

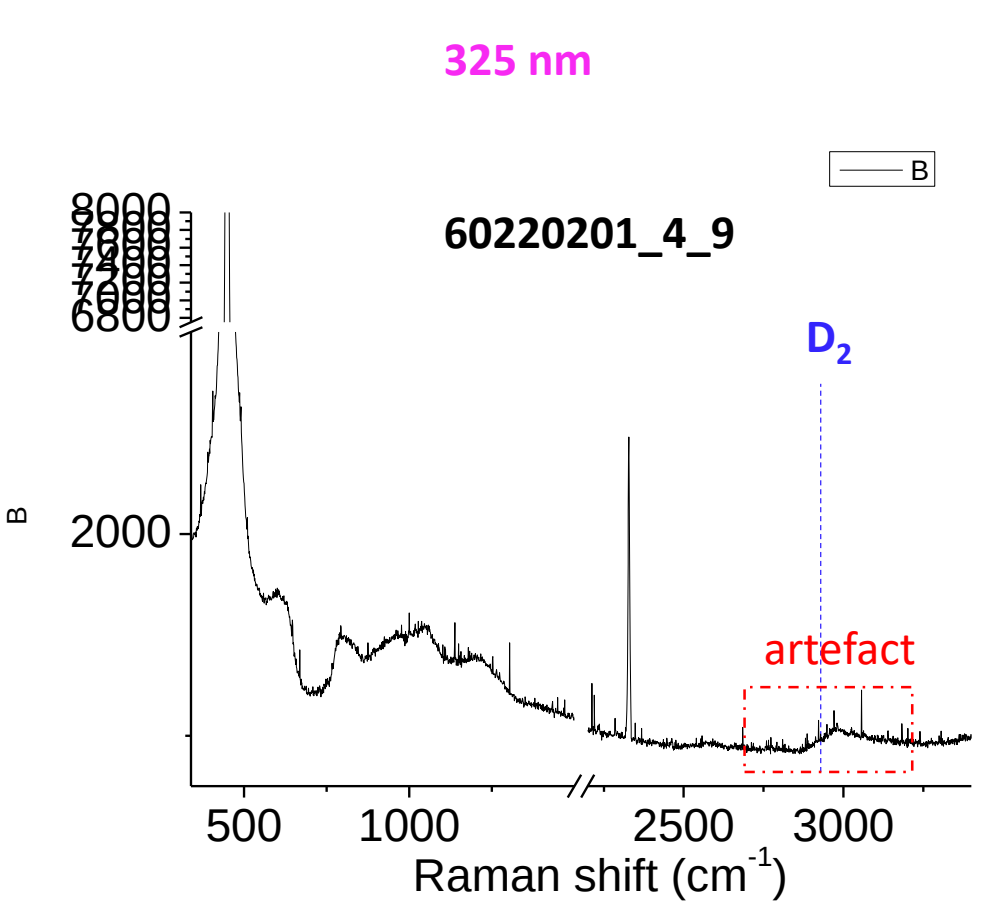


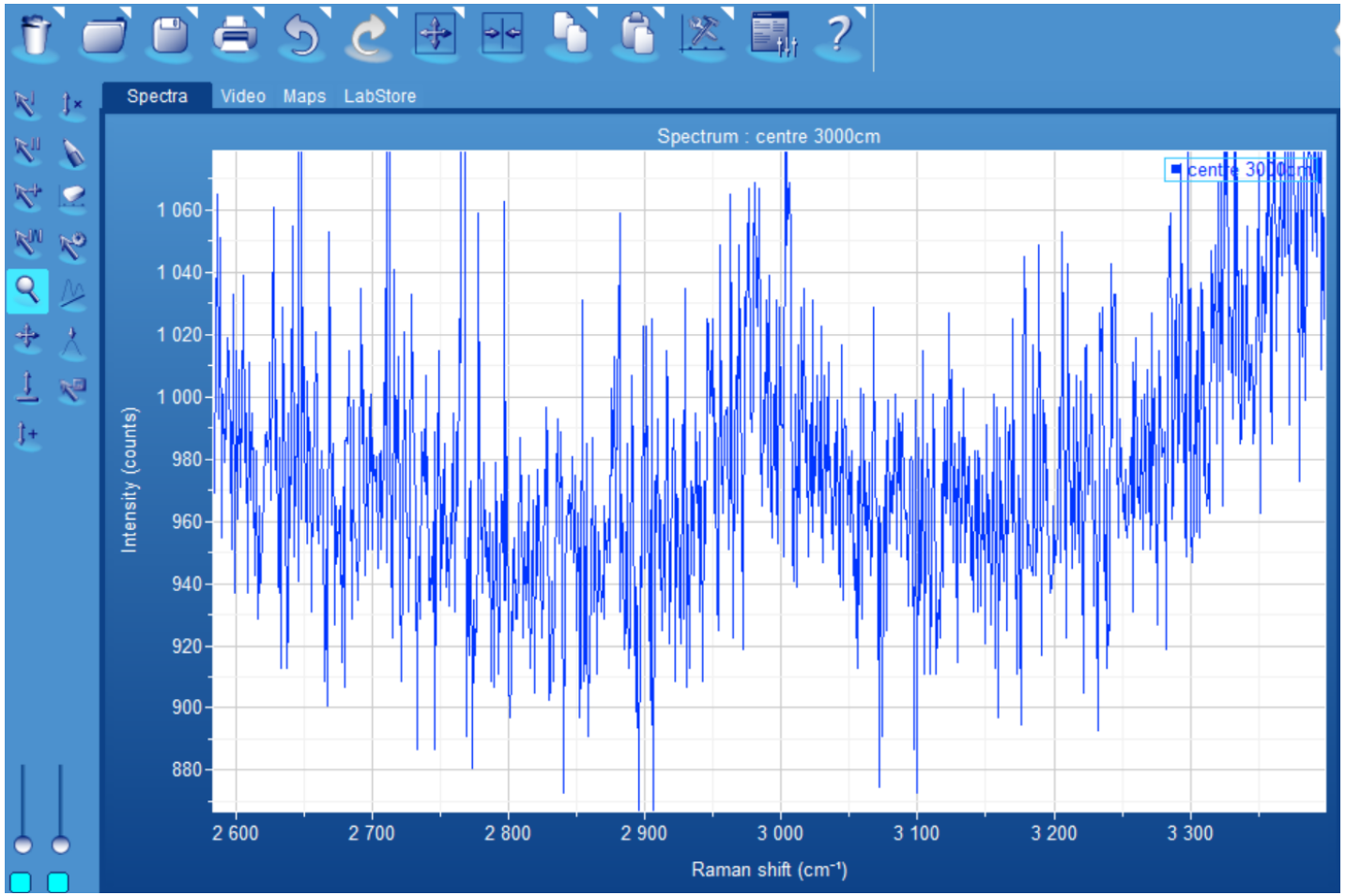
325 nm



Be/D RT→ 500°C Be/H RT→500°C

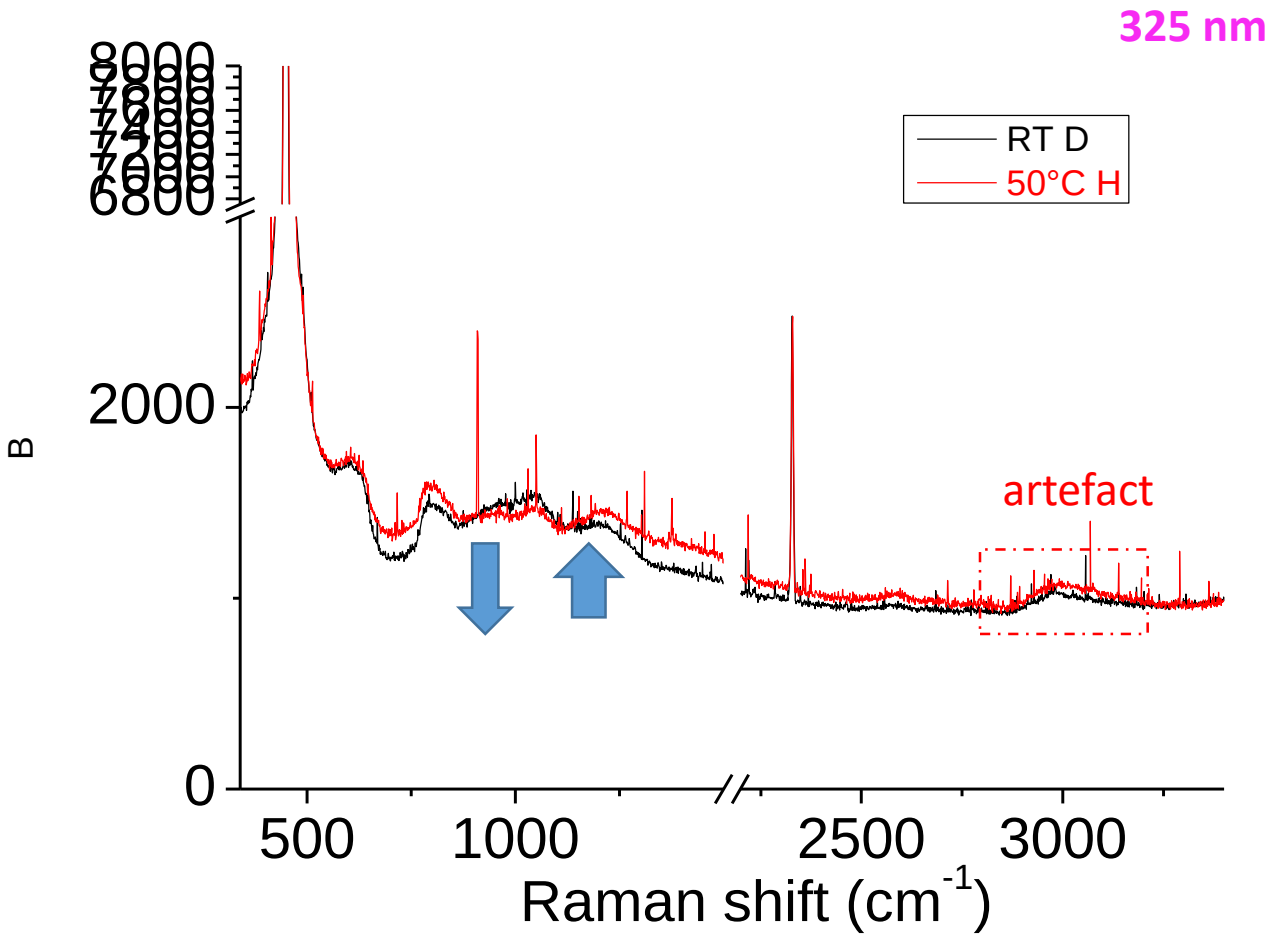
End of march 2022: *start acquisition*



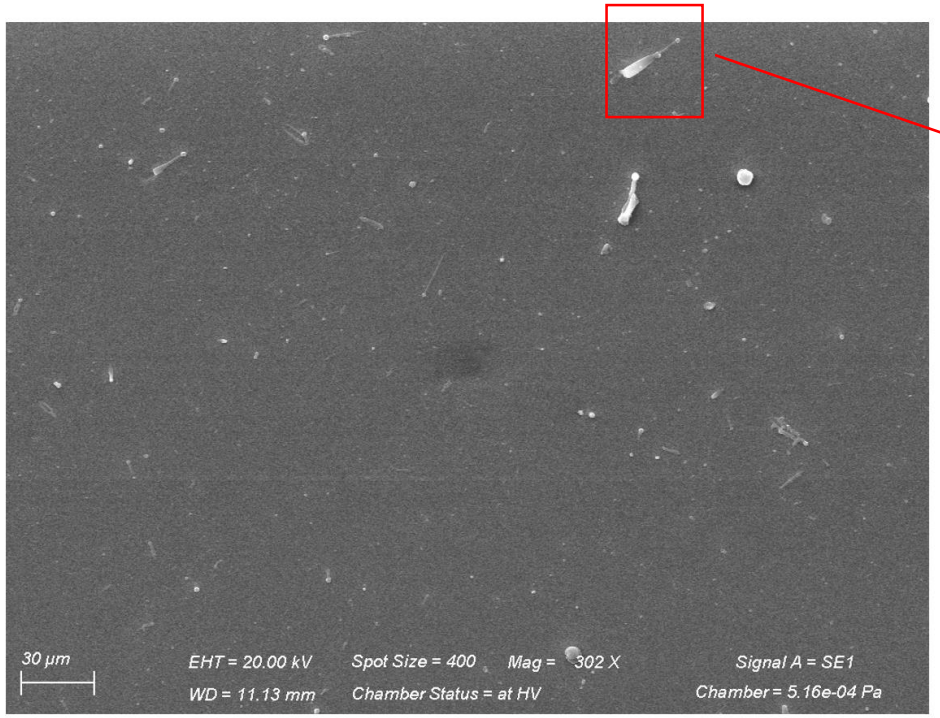


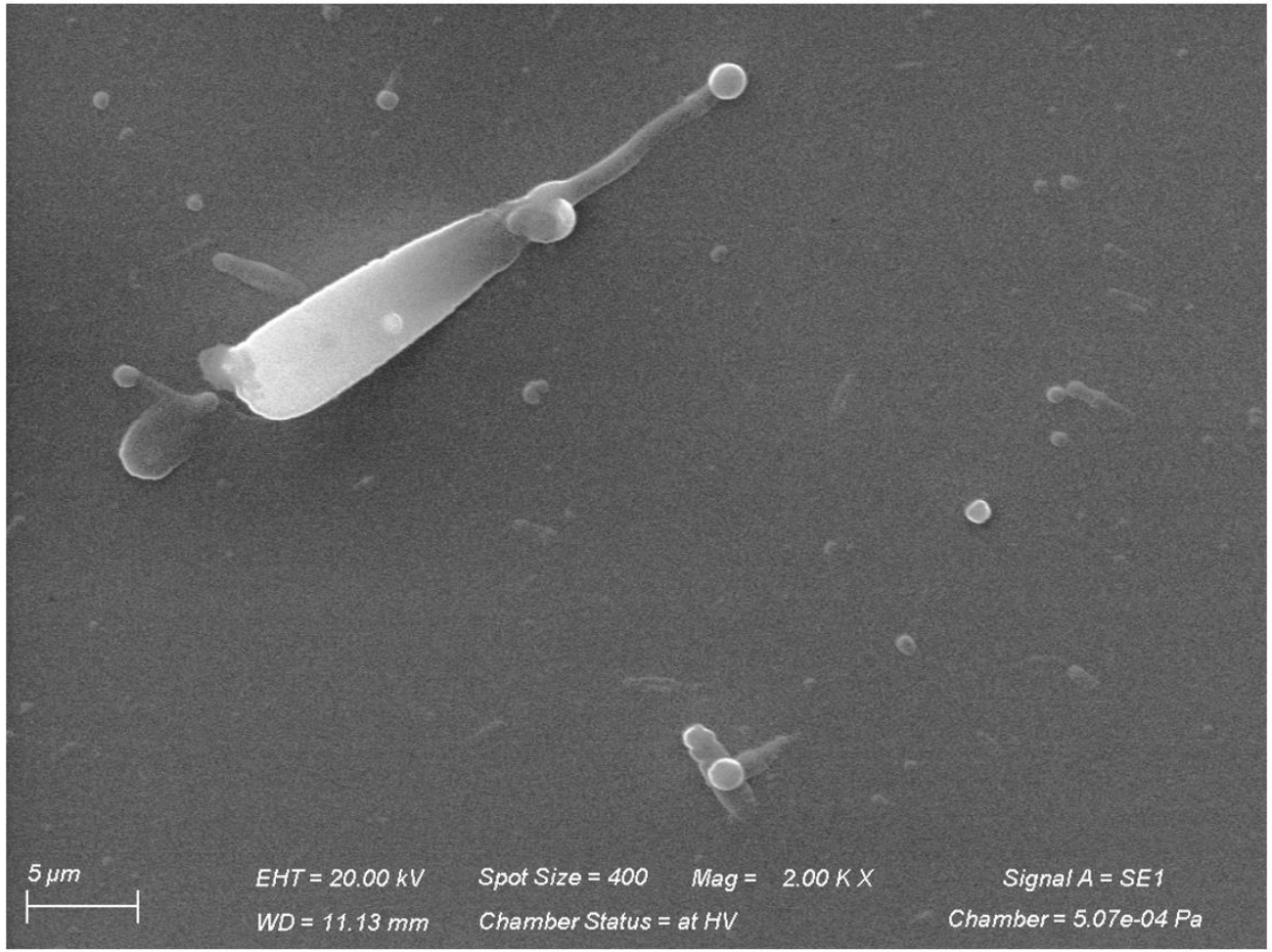
Be/D RT→ 500°C Be/H RT→500°C

End of march 2022: *start acquisition*

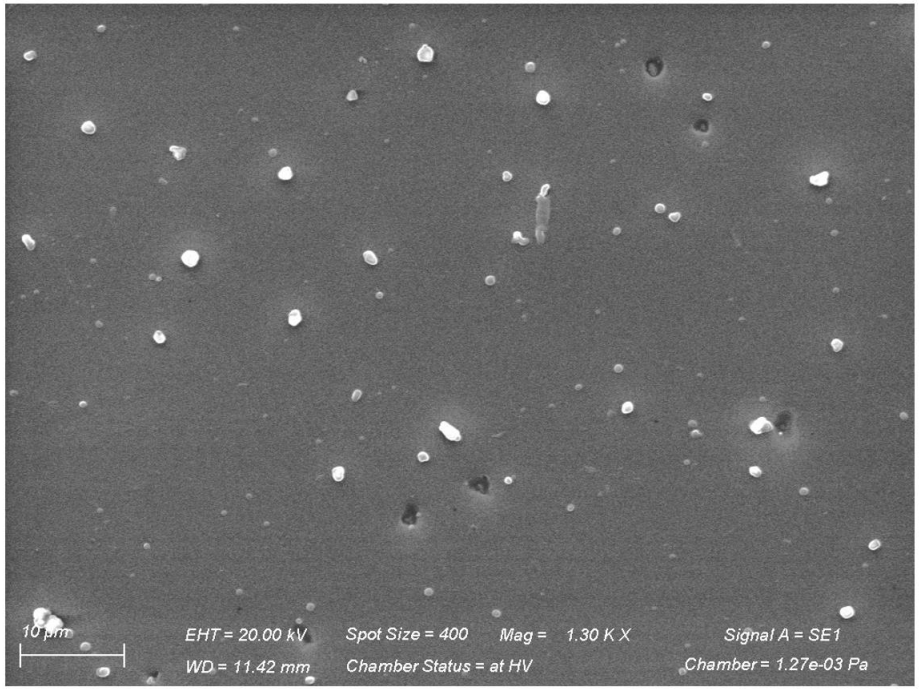


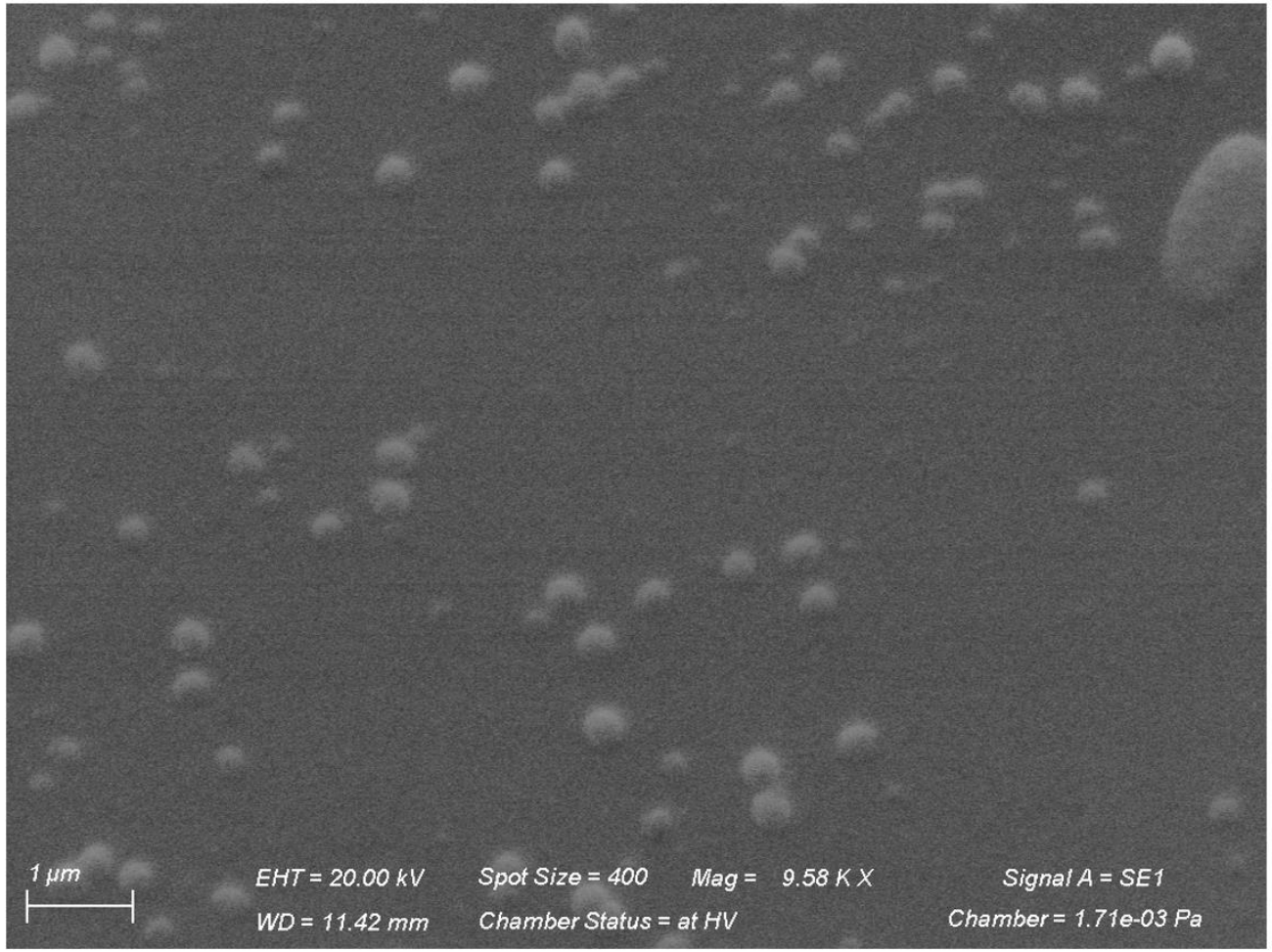
Be/D RT 602111013



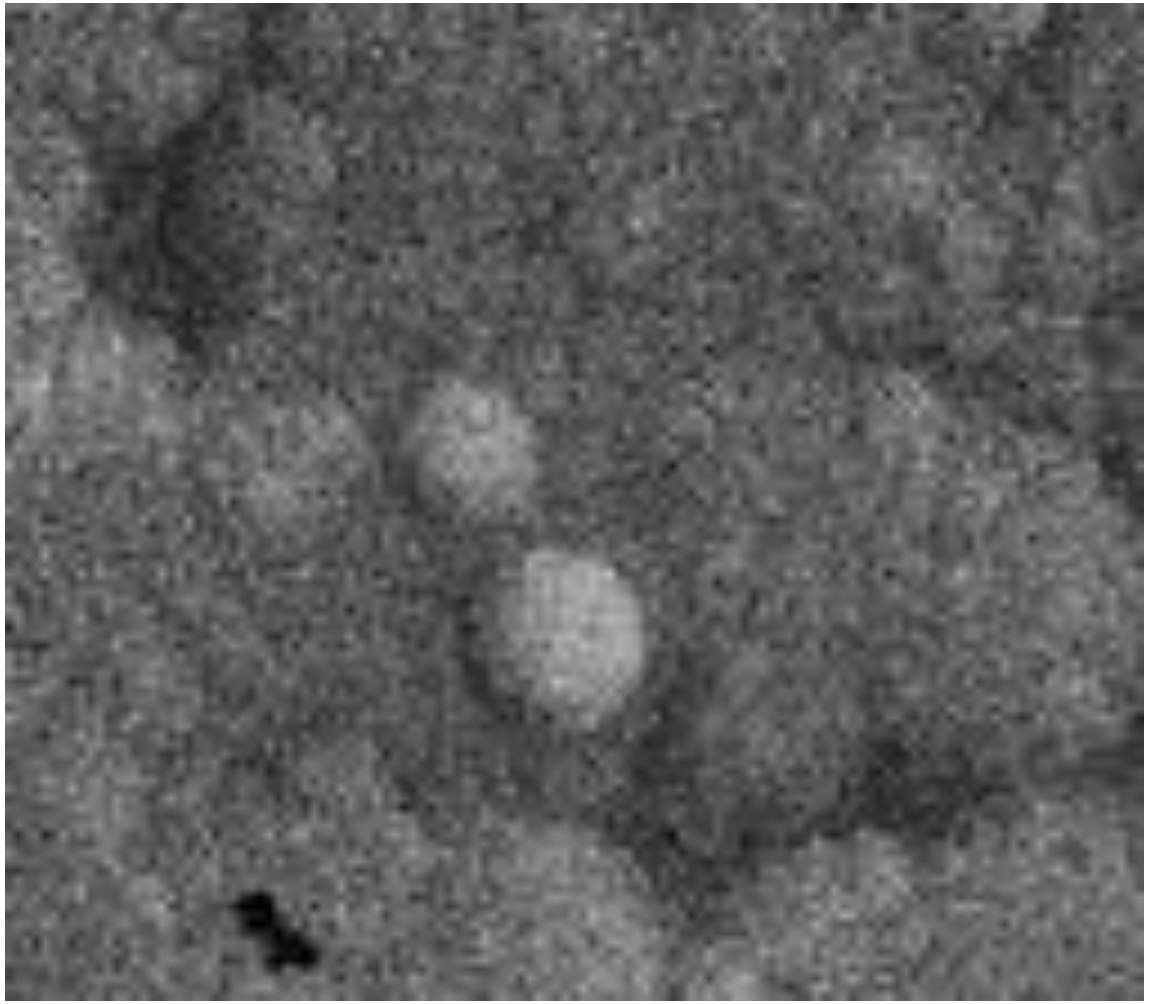


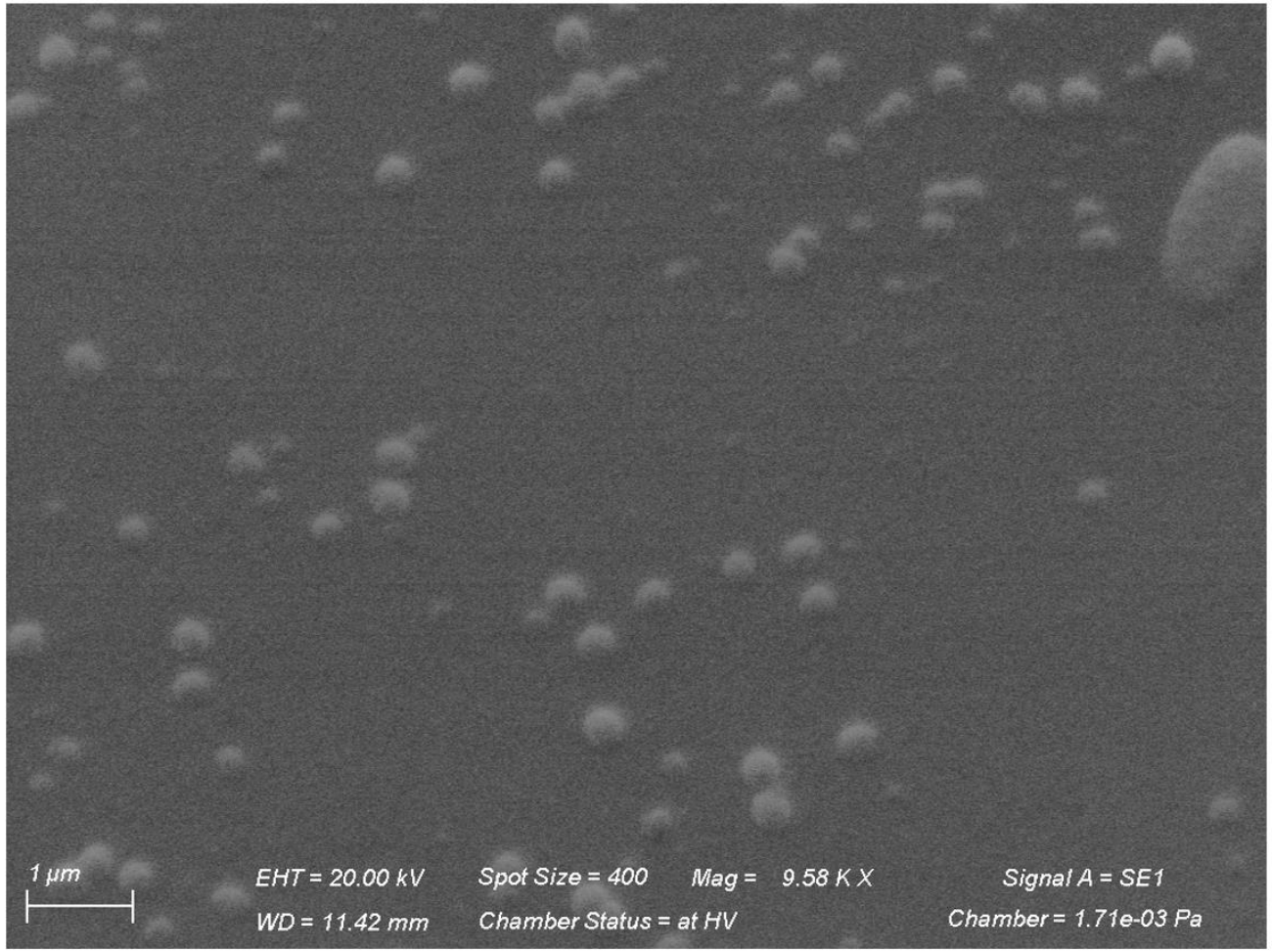
Be/D RT 602111018



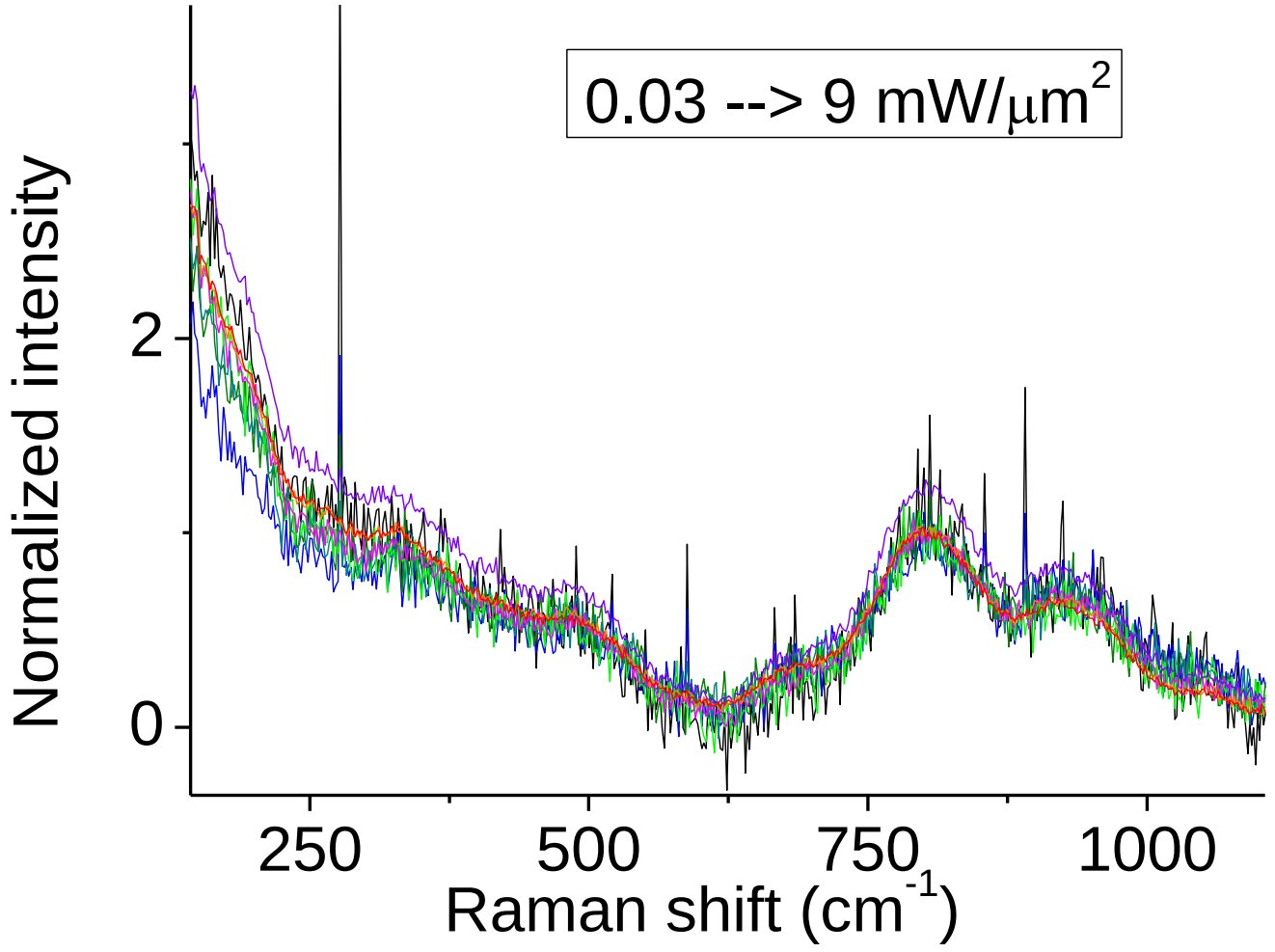


Be/D RT 602111018





ENEA/W+O (10-20 at.%)

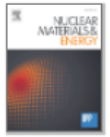


Thanks for your attention

Coming back to Be/D post heating samples

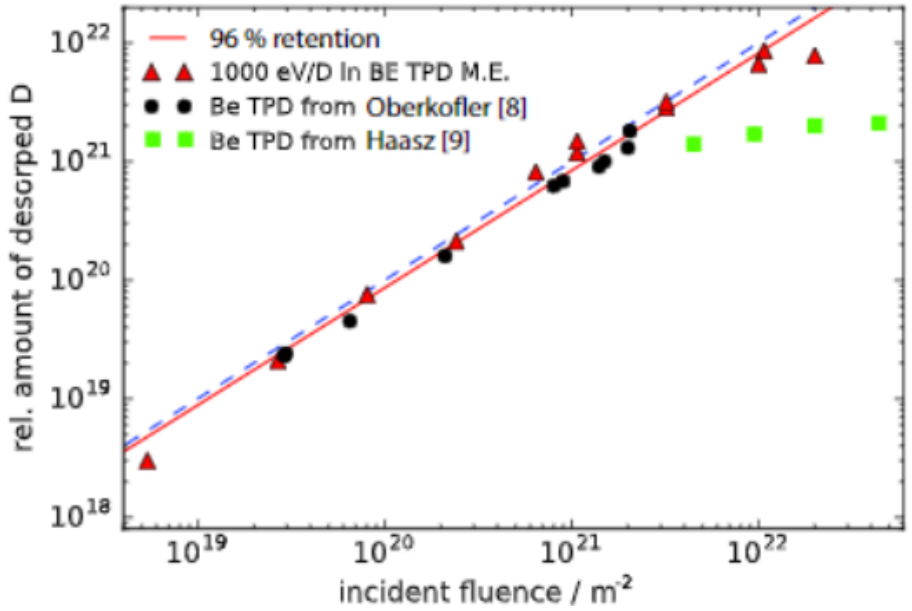
ELSEVIER

Nuclear Materials and Energy
Volume 19, May 2019, Pages 440-444

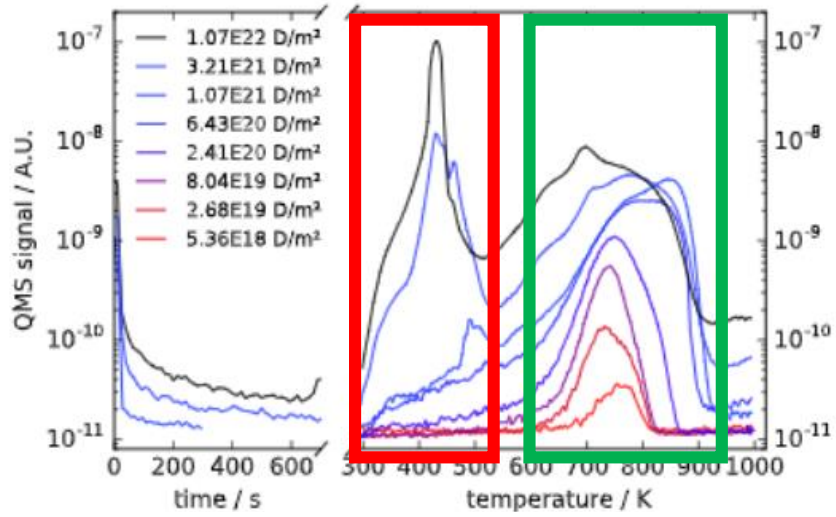


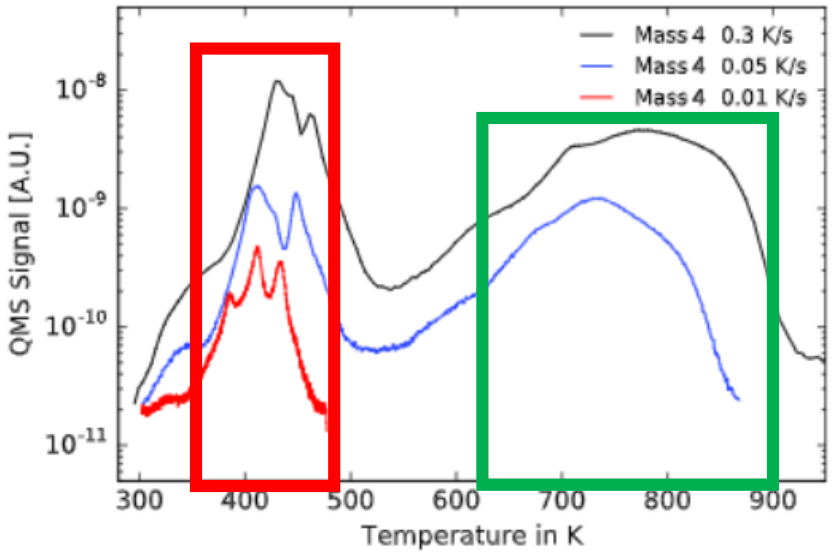
Investigation of hydrogen isotope retention mechanisms in beryllium: High resolution TPD measurements

Michael Eichler ✉



Low T peak **high T peak**





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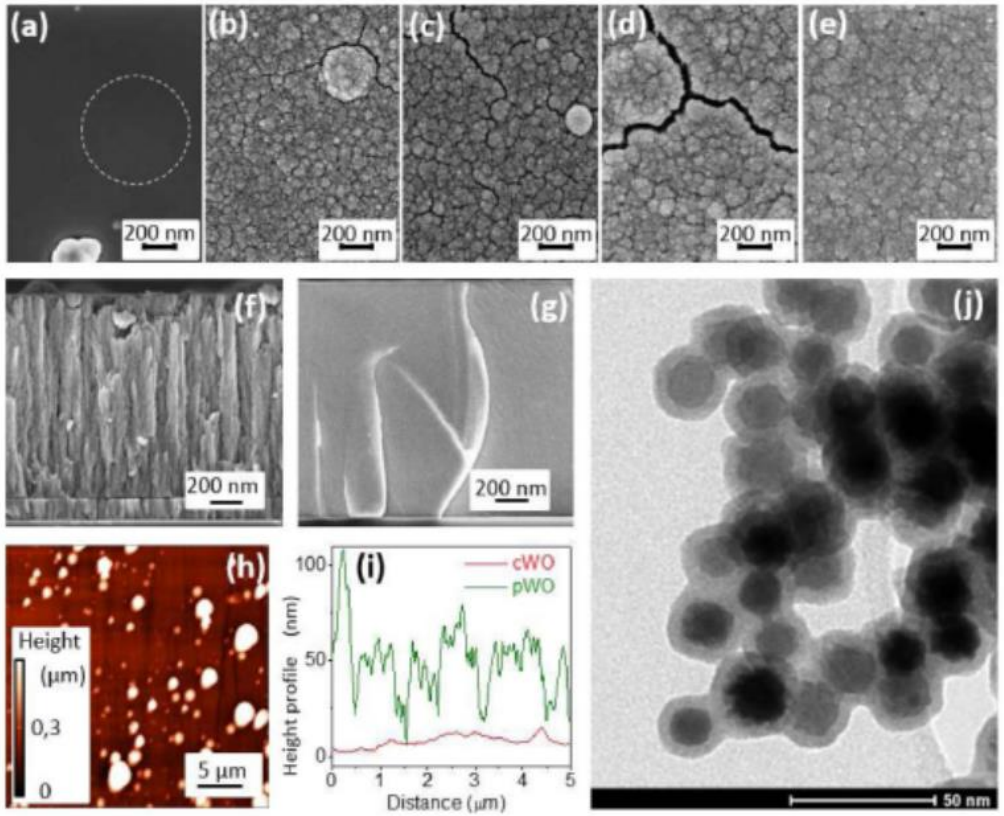
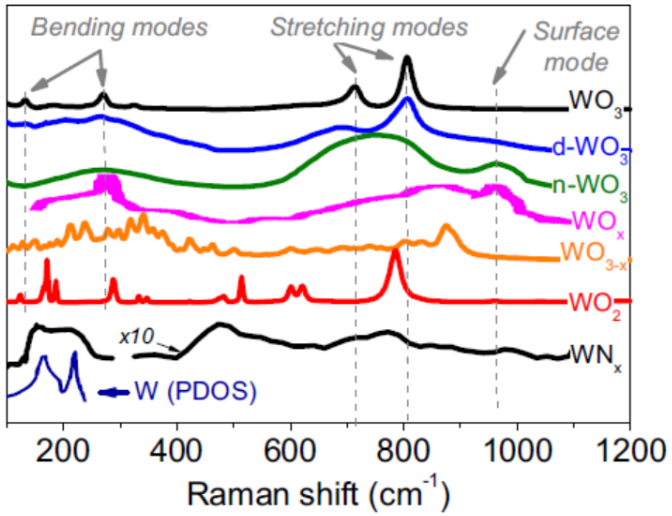
Nuclear Fusion
Nucl. Fusion 60 (2020) 086004 (15pp)
https://doi.org/10.1088/1741-4326/ab9347

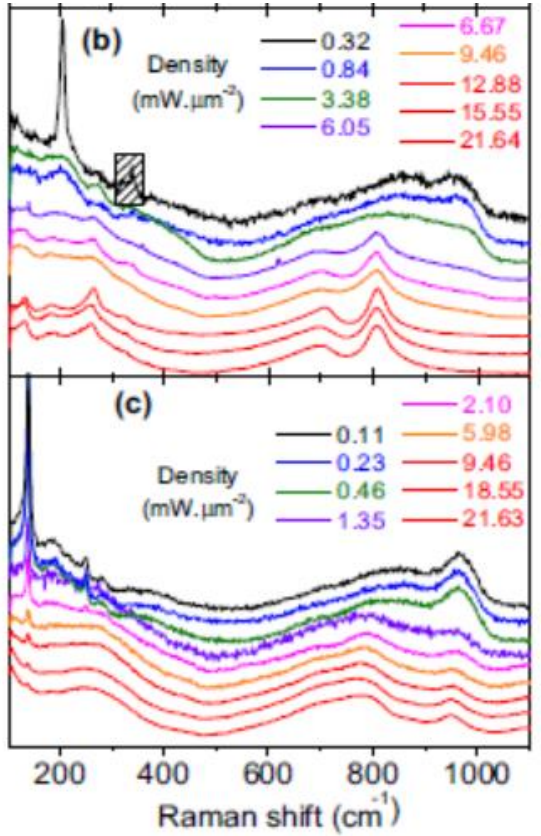
Post-mortem analysis of tungsten plasma facing components in tokamaks: Raman microscopy measurements on compact, porous oxide and nitride films and nanoparticles

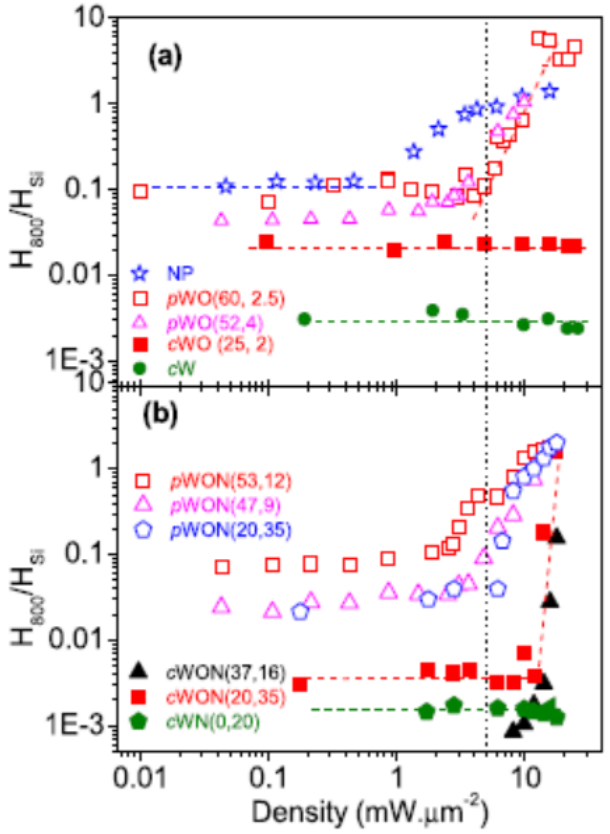
C. Pardanaud[1], D. Dellasega[2,3], M. Passoni[2,3], C. Martin[1], P. Roubin[1], Y. Addab[1], C. Arnas[1], L. Couëdel[1,4], M. Minissale[1], E. Salomon[1], G. Giacometti[1], A. Merlen[5], E. Bernard[6], R. Mateus[7], E. Alves[7], Z. Siketic[8], I. Bogdanovic Radovic[8] and A. Hakola[9]

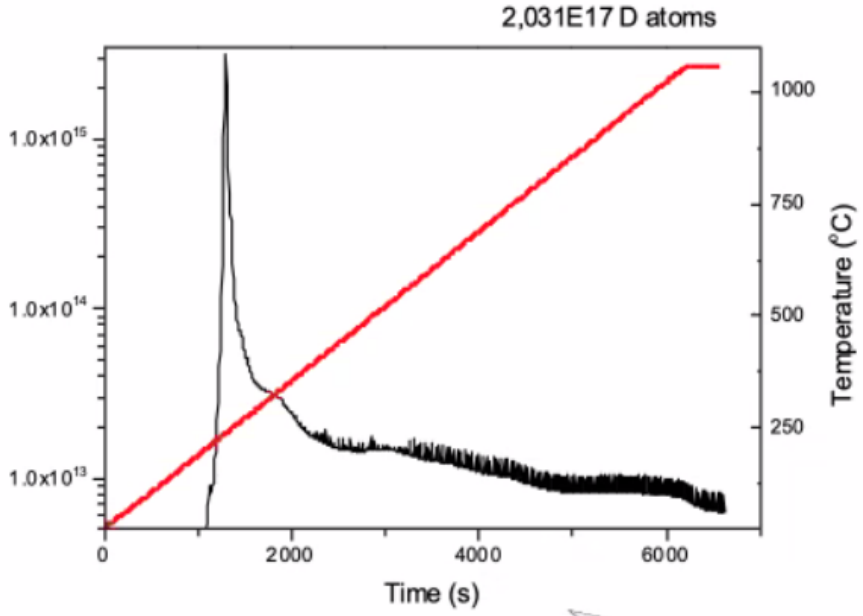


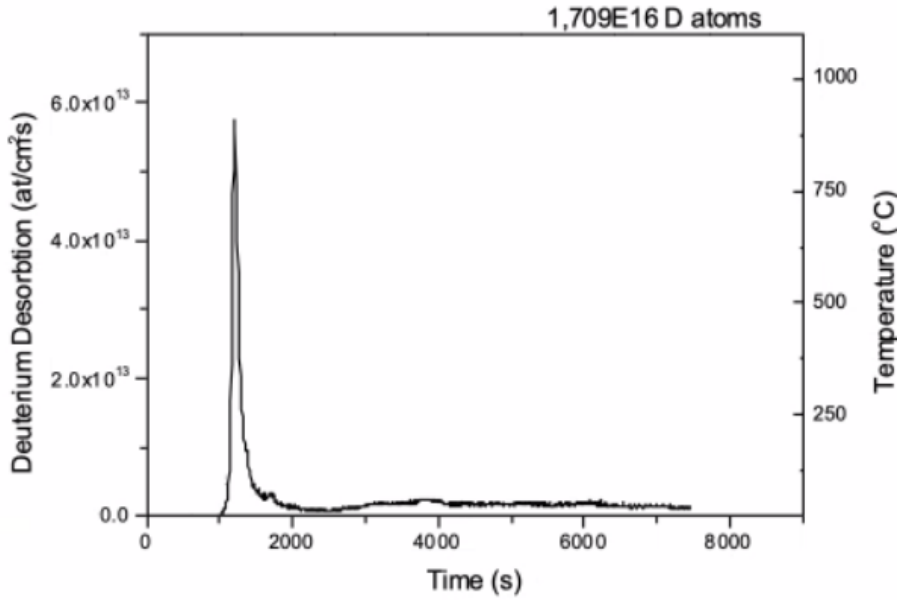


W / WO









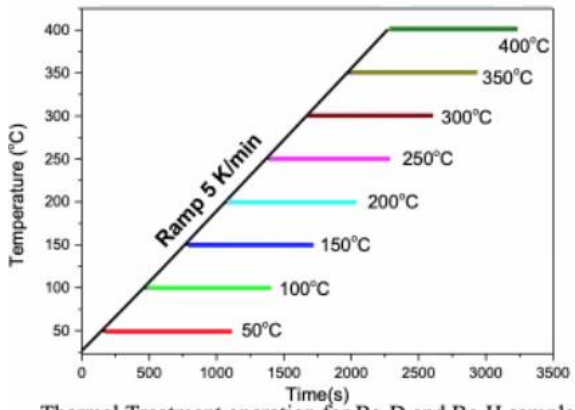
Sample name	U (kV) I(A)	Ar:D (sccm)	Bias voltage	Pressure	Thinness	Deuterium Concentration
60211011	0.39 0.43	20:20	-	1E-2	437,5 nm	6.7%
60211012	0.38 0.40	20:20	-100V	1E-2	475 nm	11.32%
60211013	0.37 0.42	20:20	-150V	1E-2	512,5 nm	20.98%
60211018	0.44 0.23	20:20	-150	2E-2	400nm	14.52%
60211021	0.41 0.28	20:8	-150	2E-2	To be measured	To be calculated

SPB 4: Production of reference coatings:

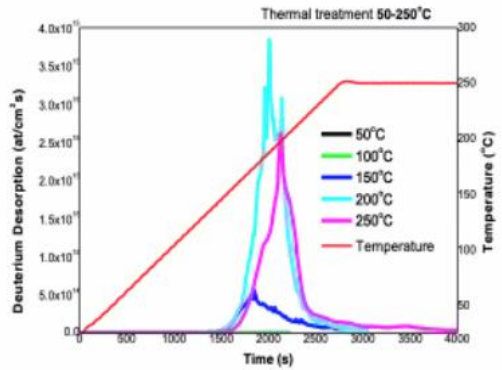
Be-based reference coatings:

- Be with D and H ~20%, 5 microns thick – 110 samples in total, thermally treated
- Be 20 microns layer, no gas; R.T. and 200 C during deposition: 12 Samples

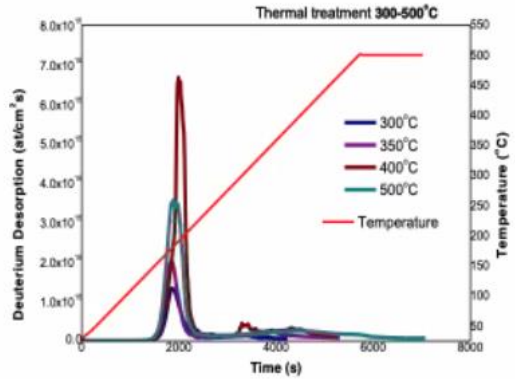
Thermal treatment and TDS Results:



Thermal Treatment operation for Be-D and Be-H sample



Deuterium release from Be-D layers on W substrates



Deuterium release from Be-D layers on tungsten substrates

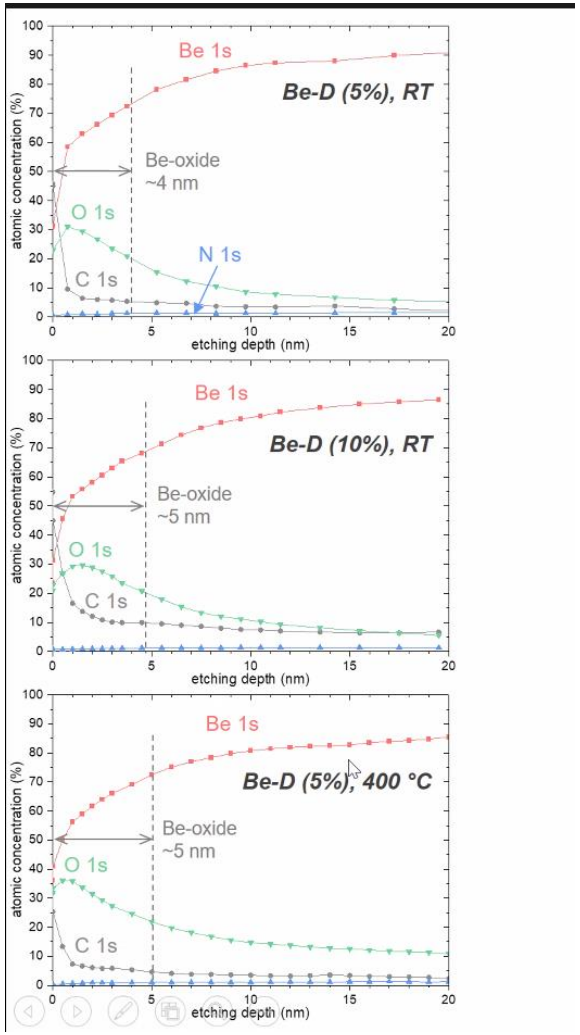
XRD, TDS, SEM measurements were performed in order to have preliminary information on samples structure and morphology.

1. **Nov. 2021** :Be with D or H ~20%, 5 microns thick – 110 samples in total, thermally treated
2. **Nov 2021**: Be 20 microns layer, no gas,;, R.T. and 200 C during deposition: 12 samples
3. **Feb 2022**: Be+O+D (5, 10 and 20 D at%) – 16 samples

1-3 Samples shipped, few analysis still undergoing.

1. **Iune 2022**: Be+D (10 D at%) 4 different temperatures: - 44 samples

Work in progress – Deposition parameters set – Production will start in April



11:15 → 11:25 **TDS and XPS measurements of the produced Be samples**

Orateurs: Dr Matjaz Panjan (JSI), Vincenc Nemanic (JSI)