

Hidden aspects of solid-state chemistry view under the hood



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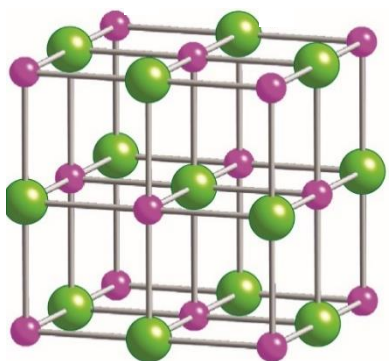


Costa Adeje, Tenerife, Spain
28. X. 2025.



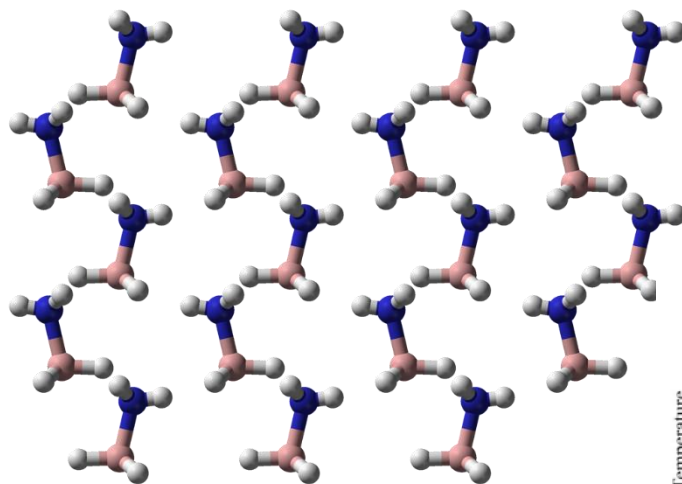
HRZZ-IP-2024-05-2450





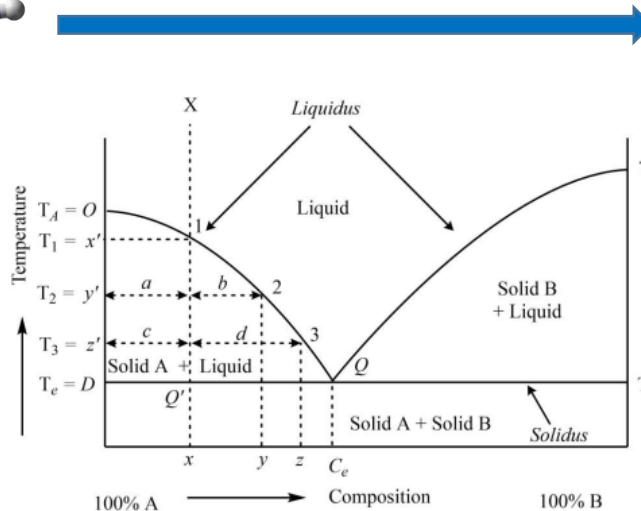
solid
reactant 1
(crystal structure 1)

+

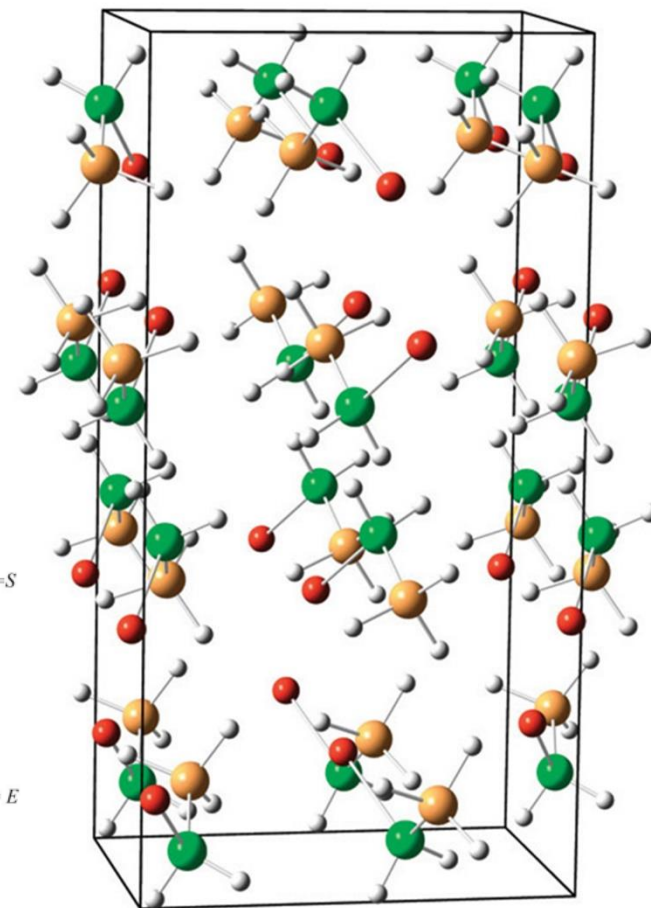


solid
reactant 2
(crystal structure 2)

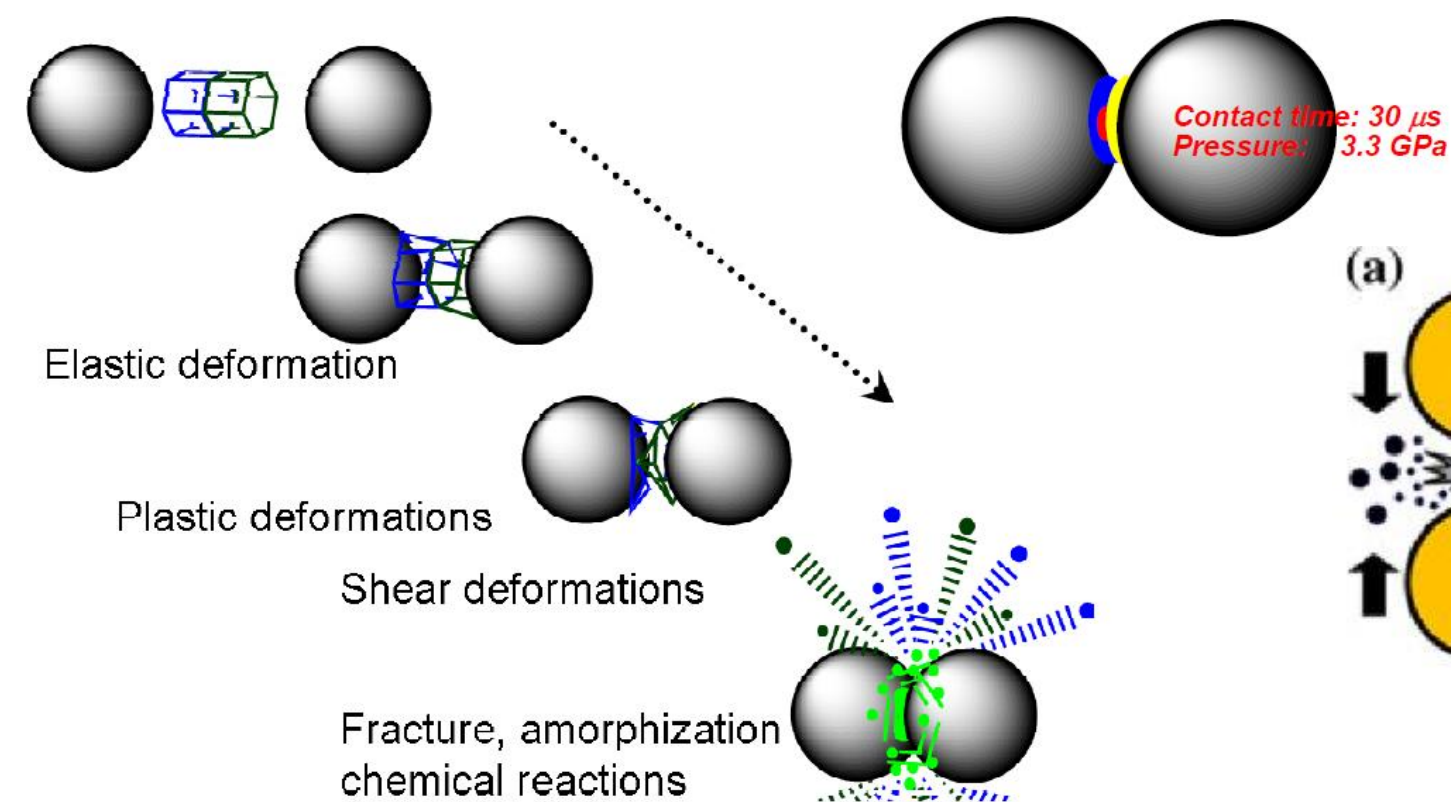
Intermediate
state



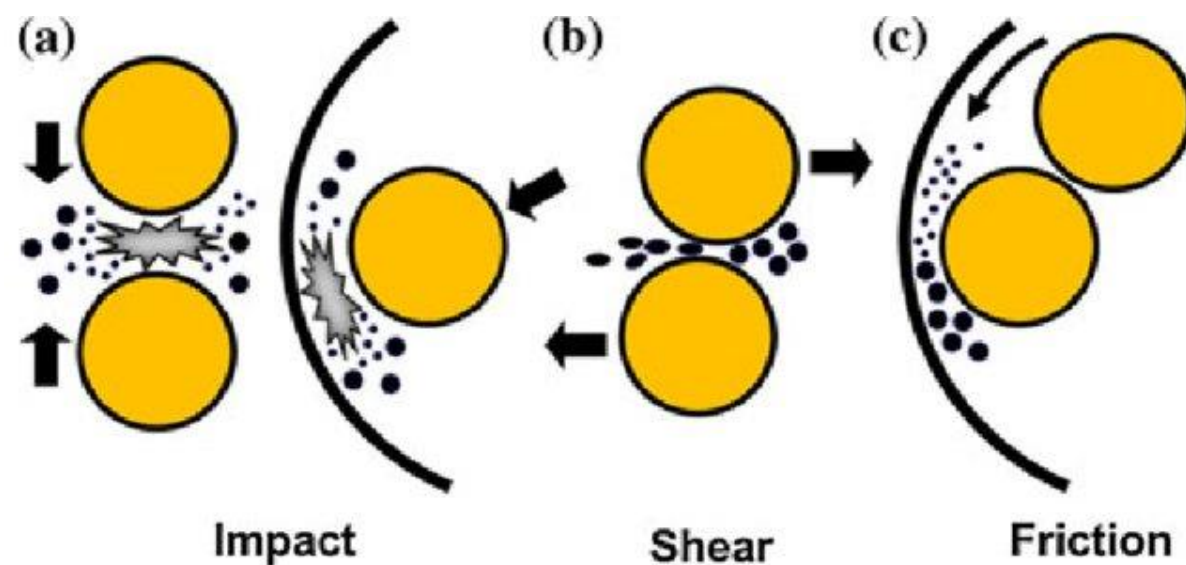
Amorphization
Liquefaction
etc.



solid
product
(crystal structure 3)



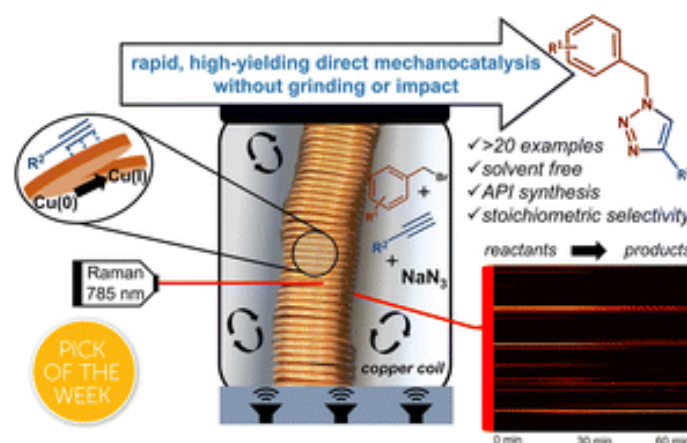
V. P. Balema, *Aldrich Mater. Sci.* (2009)



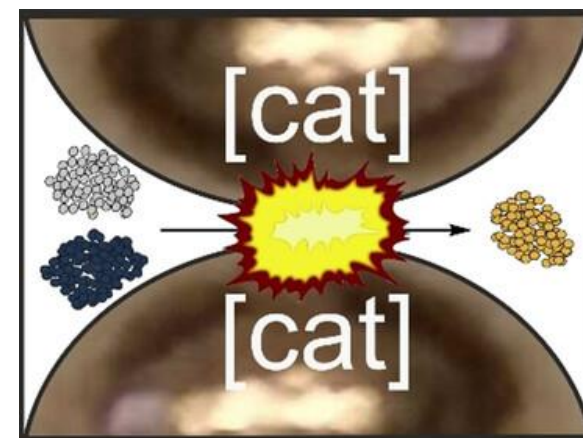
Fuentes, Takacs, *J. Mater. Sci.* **48** (2013) 598-611



Martinez et al. *Nature Chem. Rev.* **7** (2023) 51-65



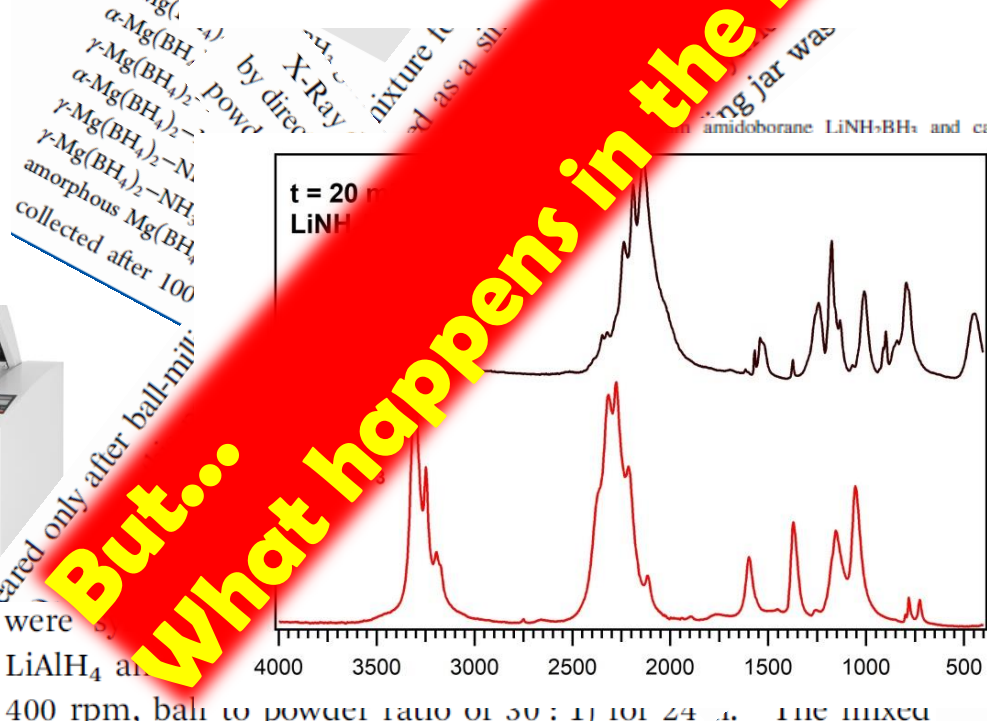
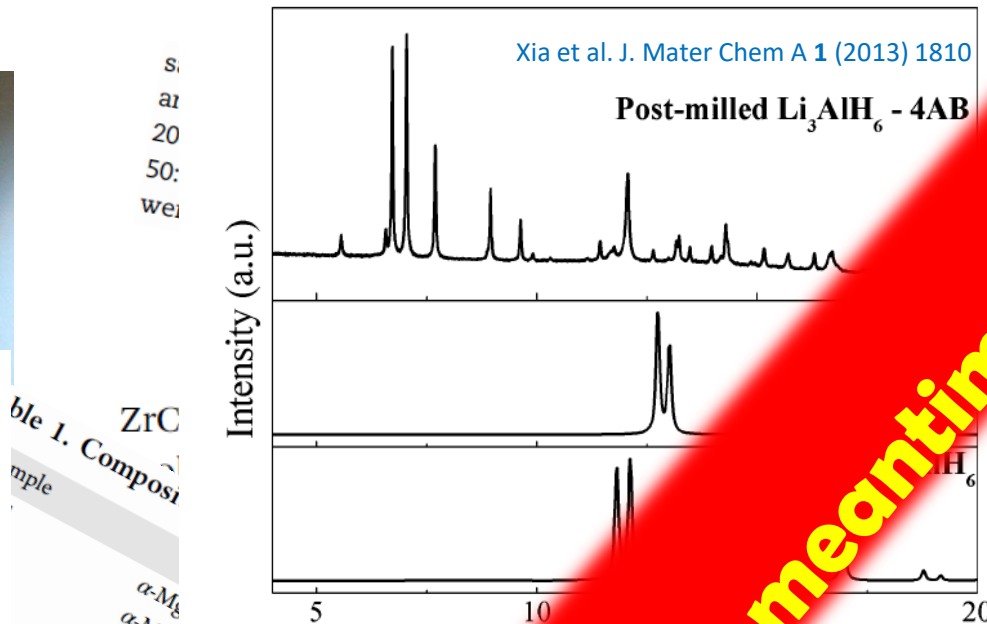
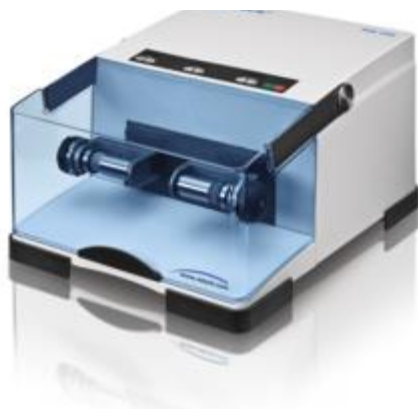
Lennox, Frišćić et al. *Chem. Sci.* **14** (2023) 7475-7481



Pichardt, Grätz, Borchardt, *Chem. Eur. J.* **26** (2020) 12903



What happens inside the milling jar?



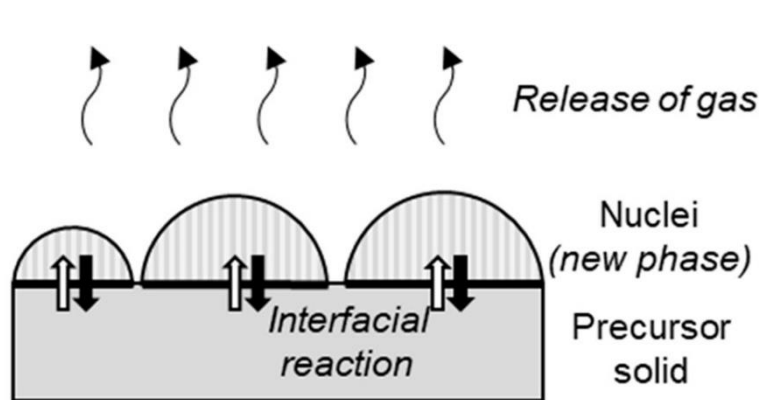
disappeared only after ball-milling

were

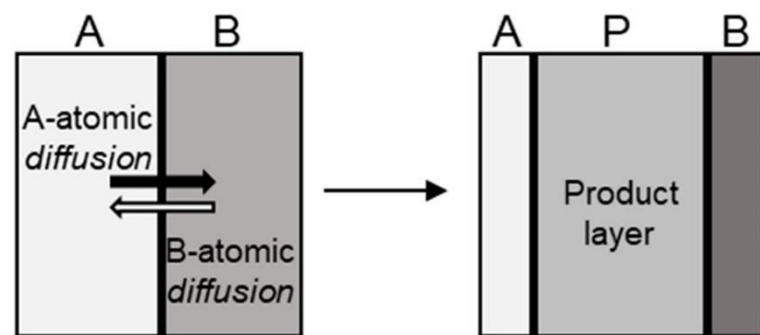
(F: LiAlH_4 and

400 rpm, ball to powder ratio of 50 : 1) for 24 h. The mixed

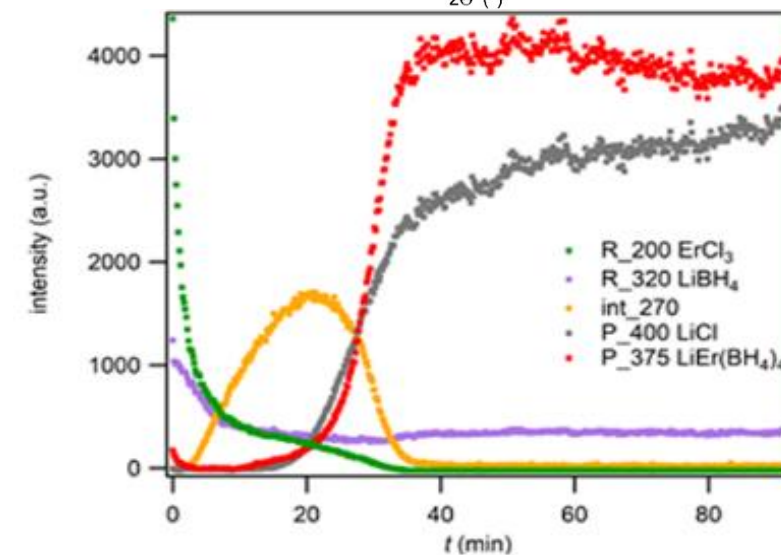
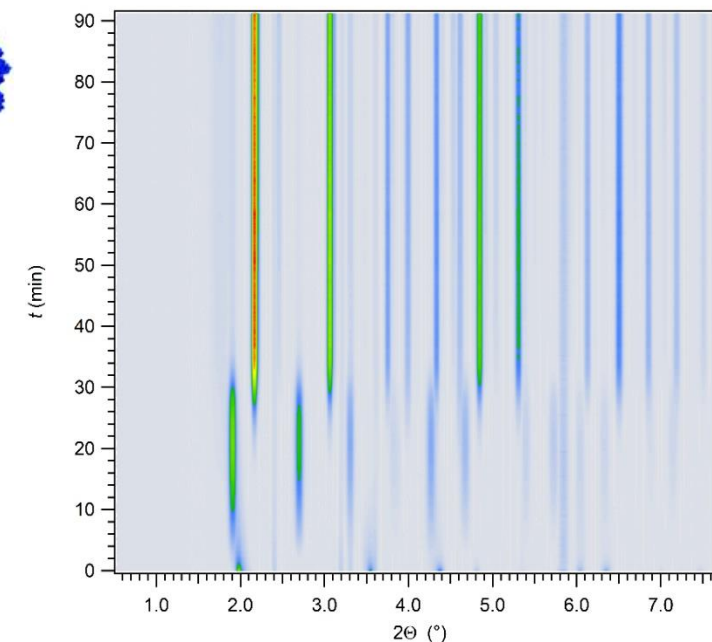
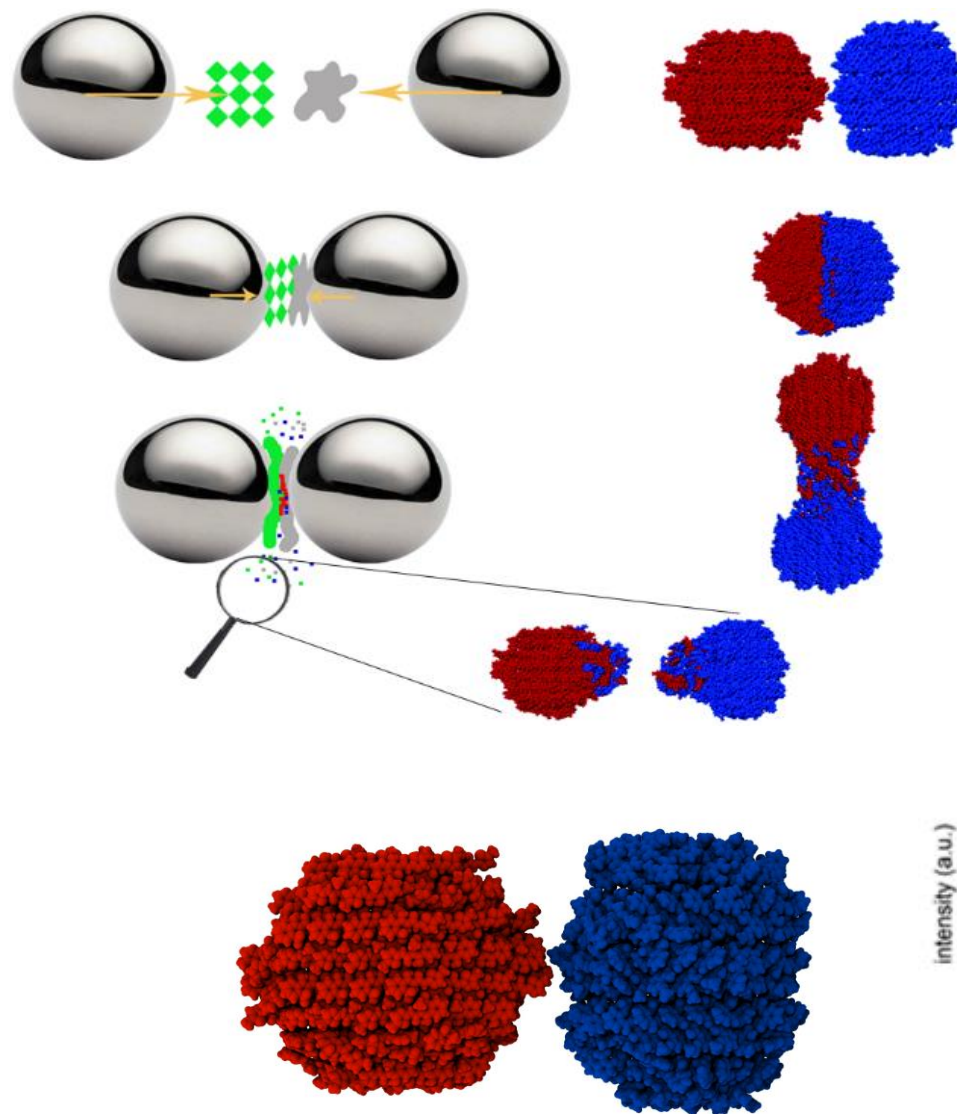
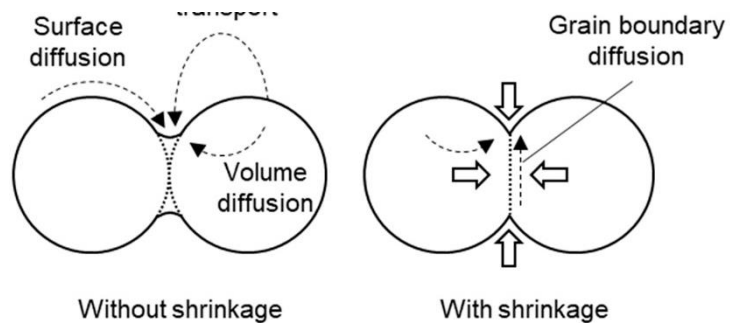
But... What happens in the meantime???



Decomposition-driven phase transition



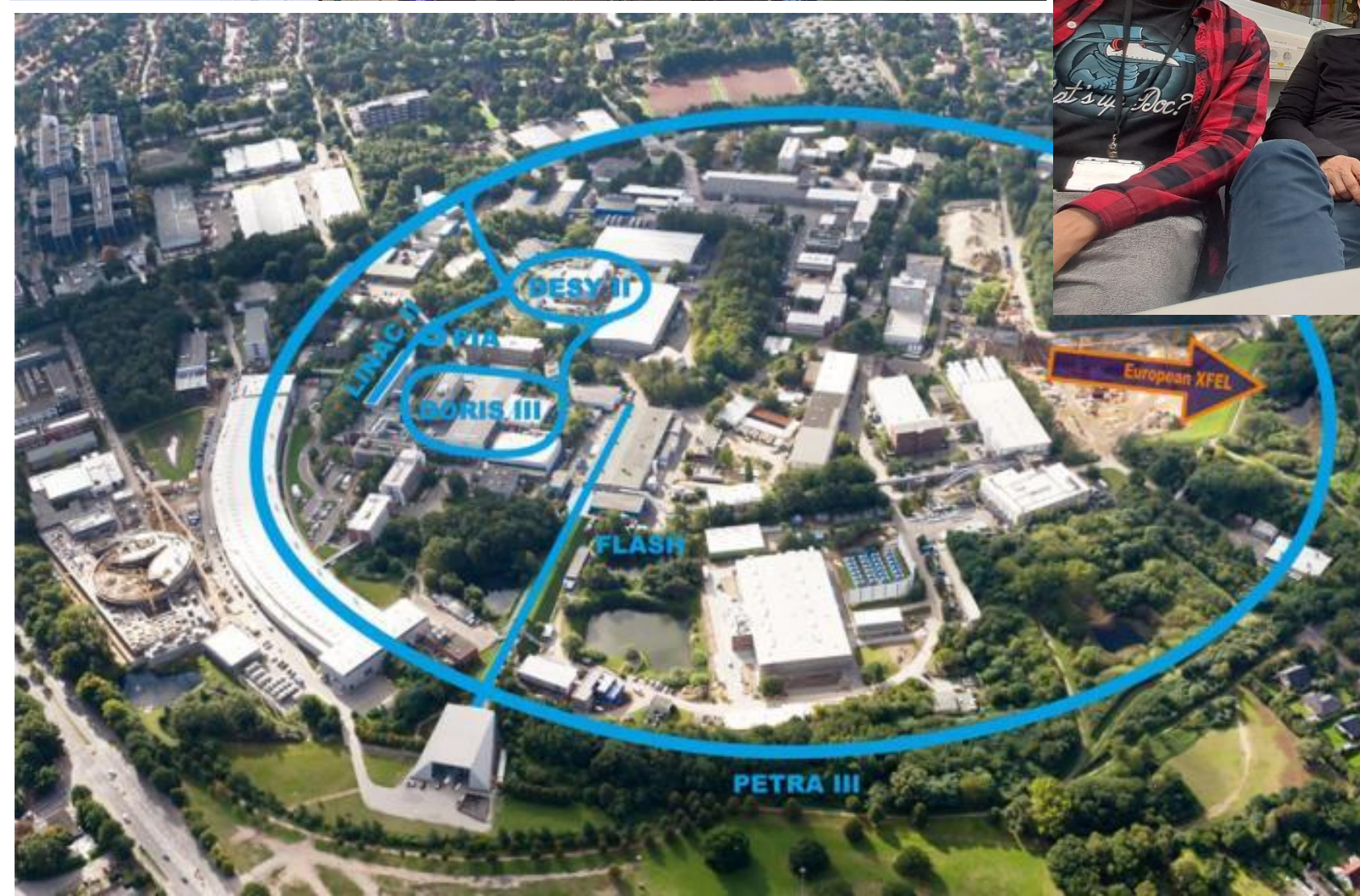
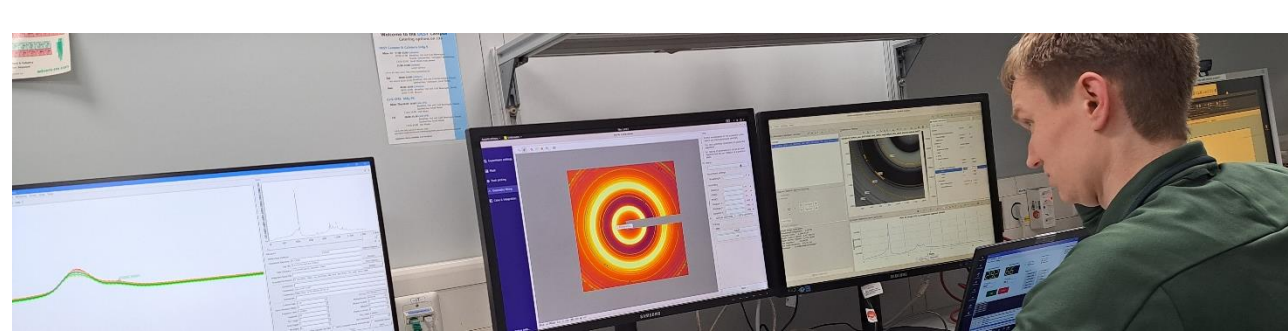
Interface (contact) reaction

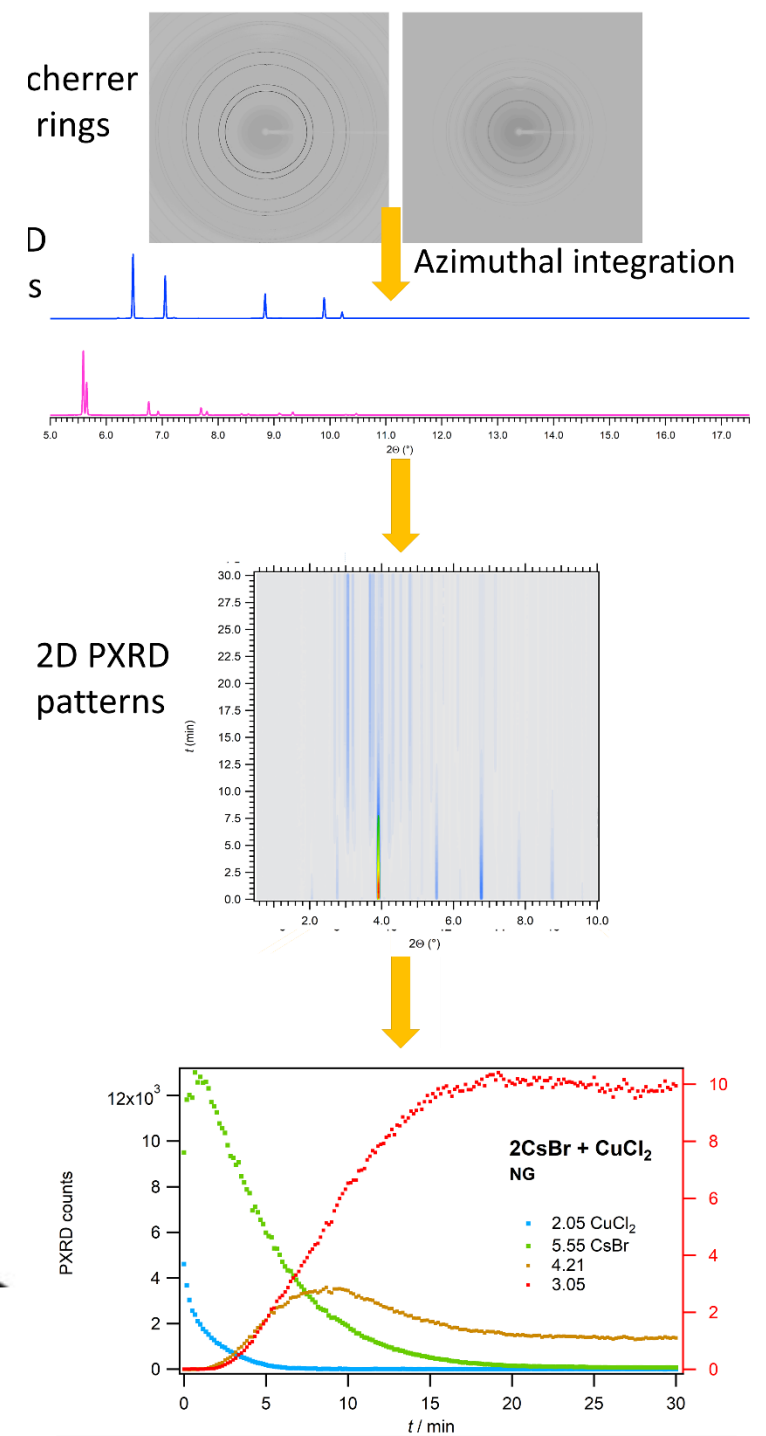
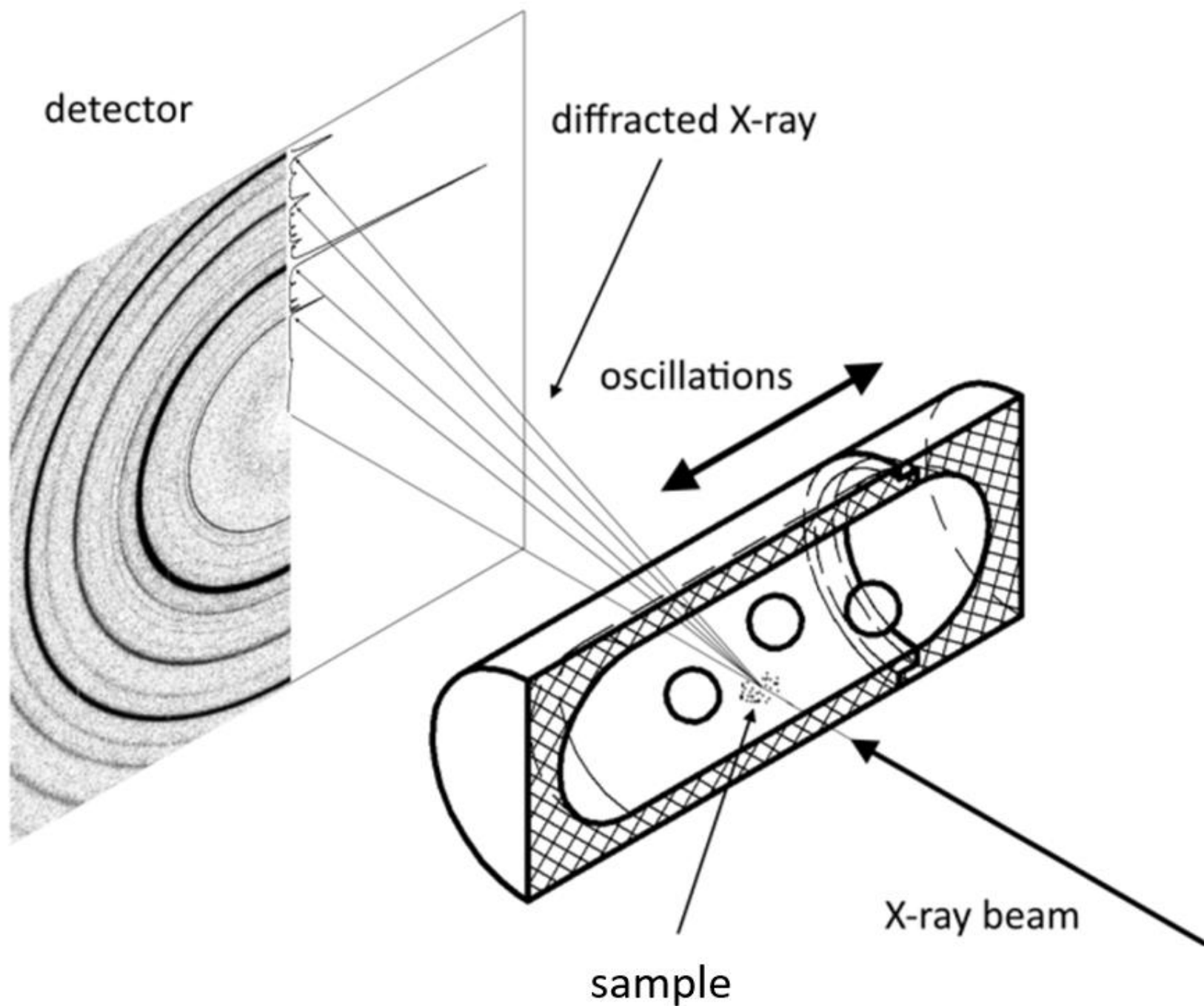


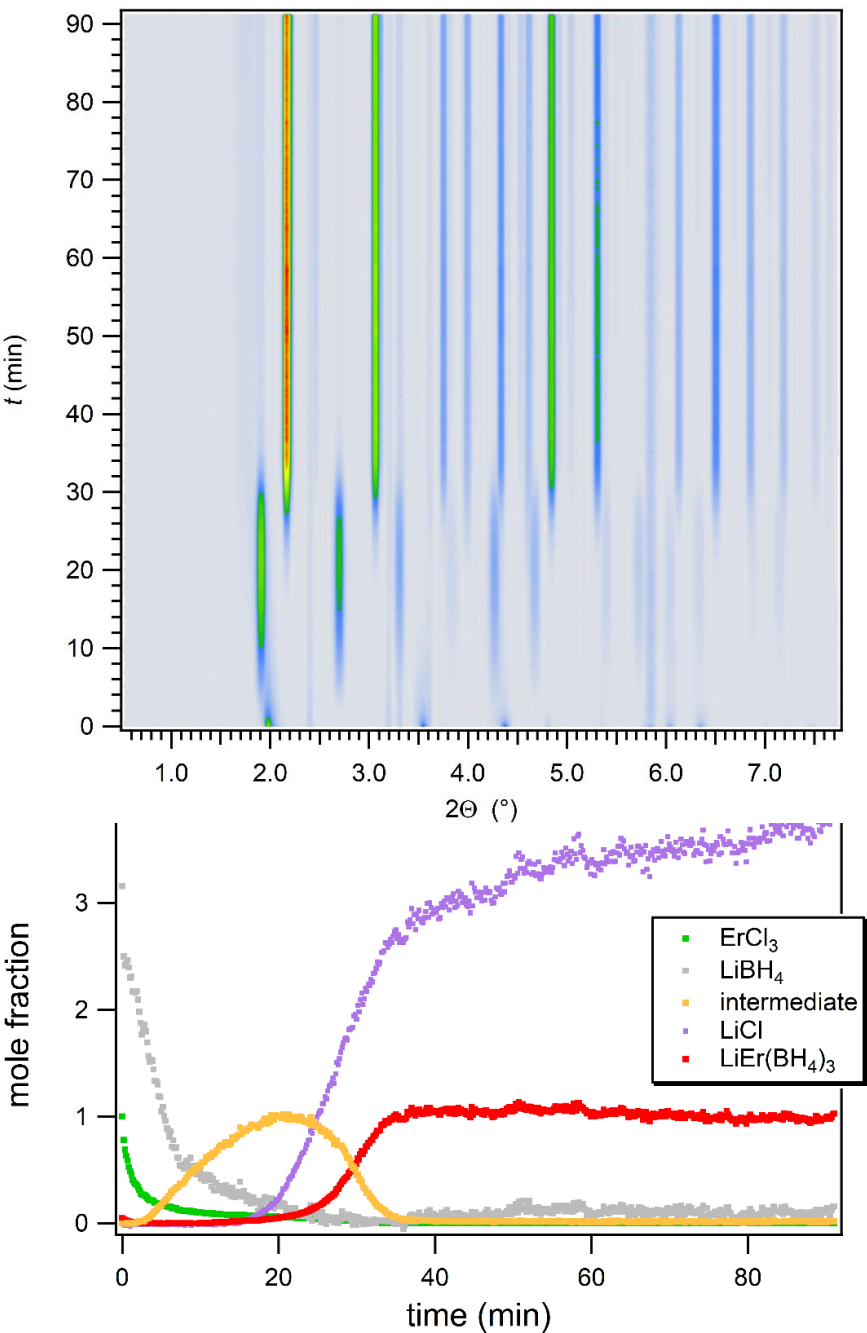
Adapted from:
M. Ferguson et al. *Chem. Sci.* **10** (2019) 2924-2929

Biliškov, Wegner, unpublished

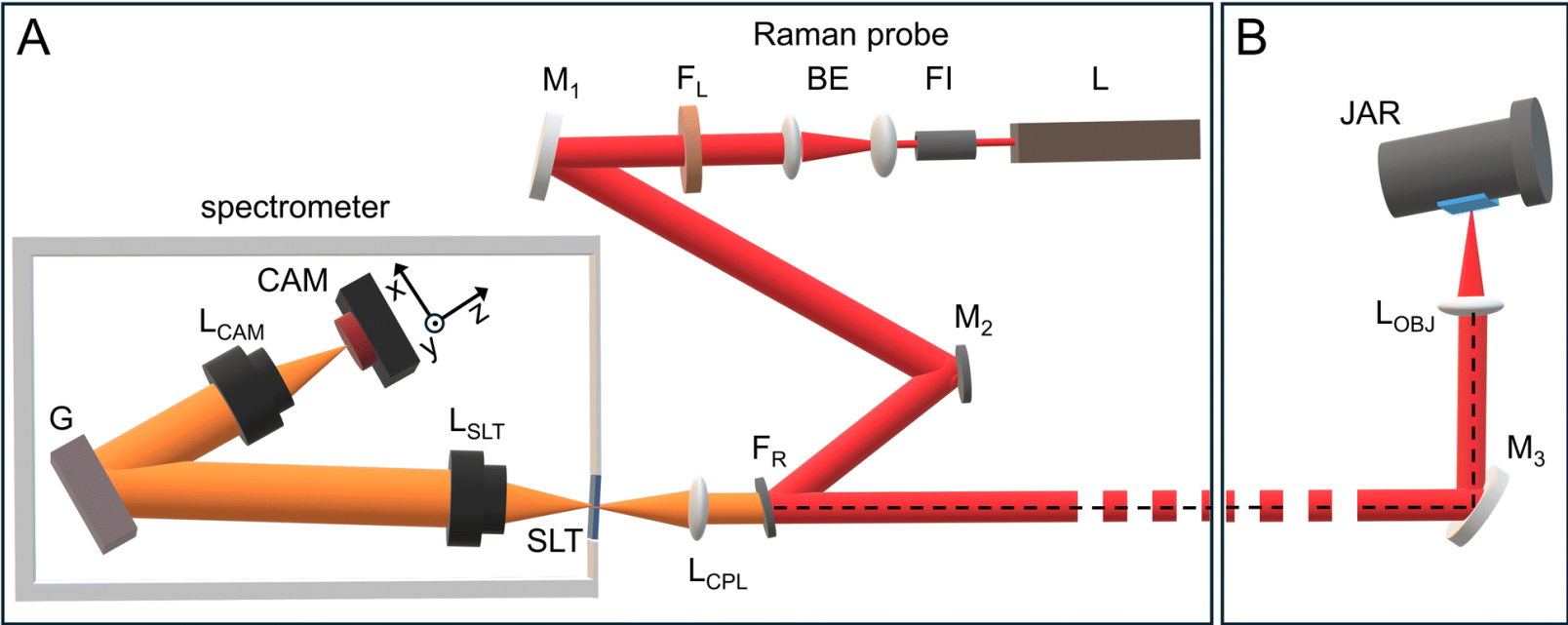
Kumar et al. *Chem. Rev.* **2022**, *122*, *15*, 12748





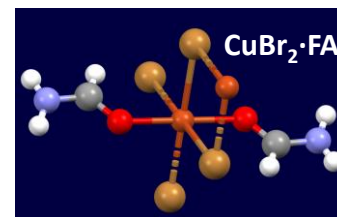
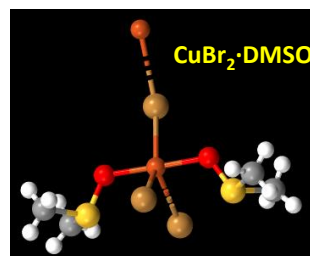
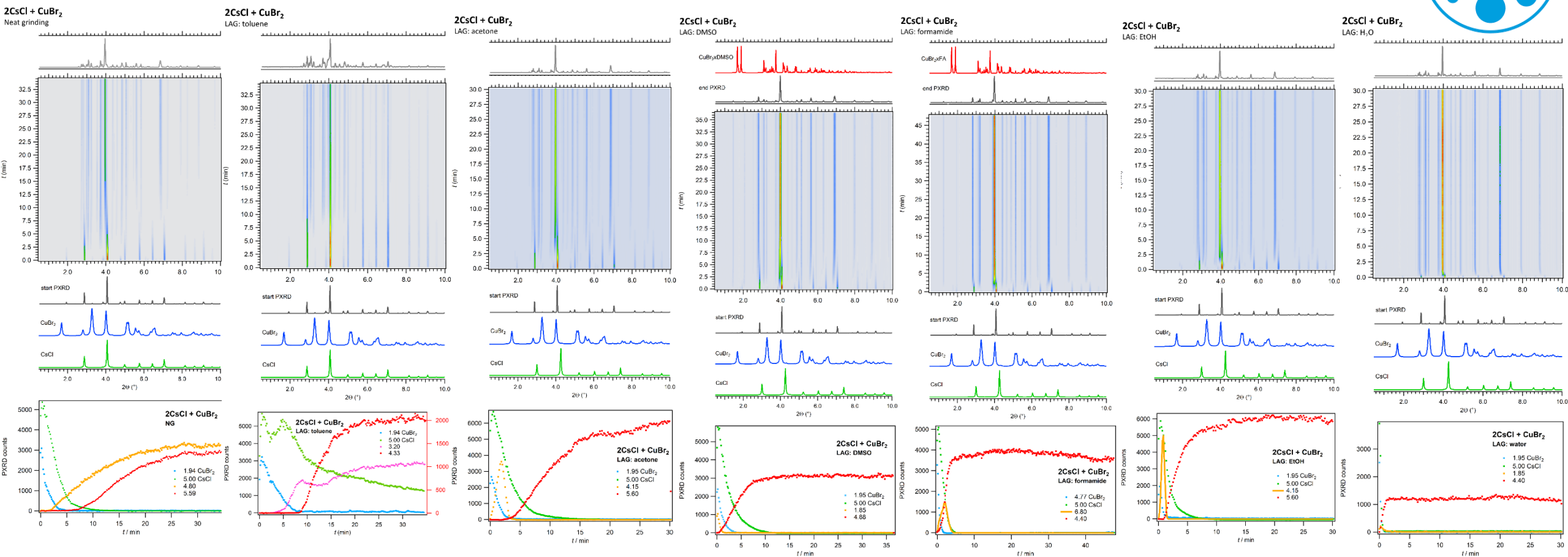


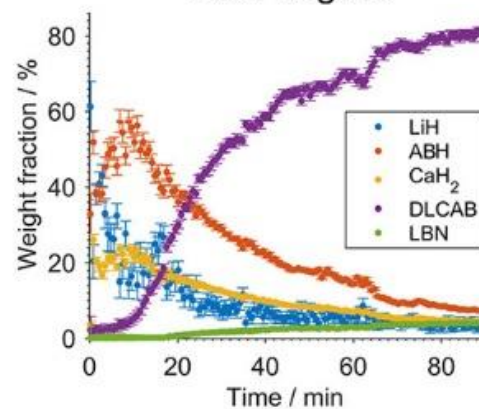
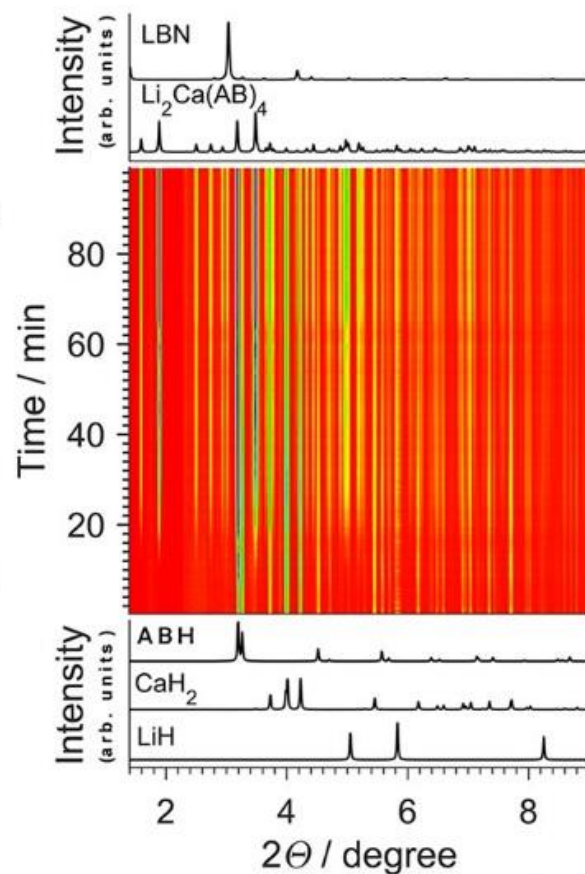
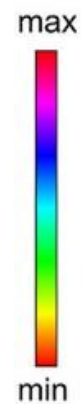
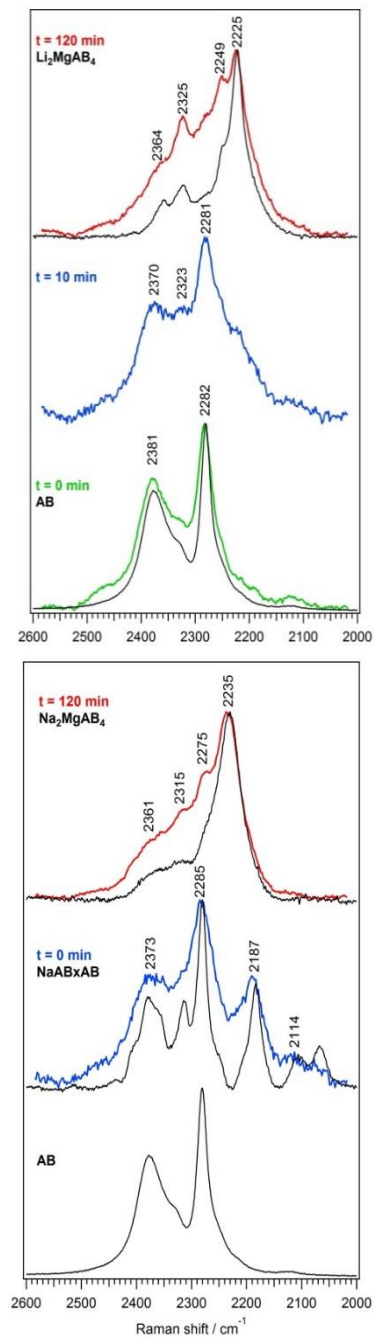
INSTITUT ZA FIZIKU



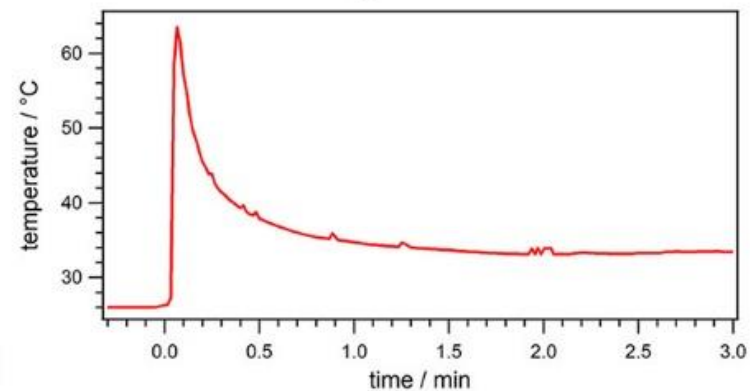
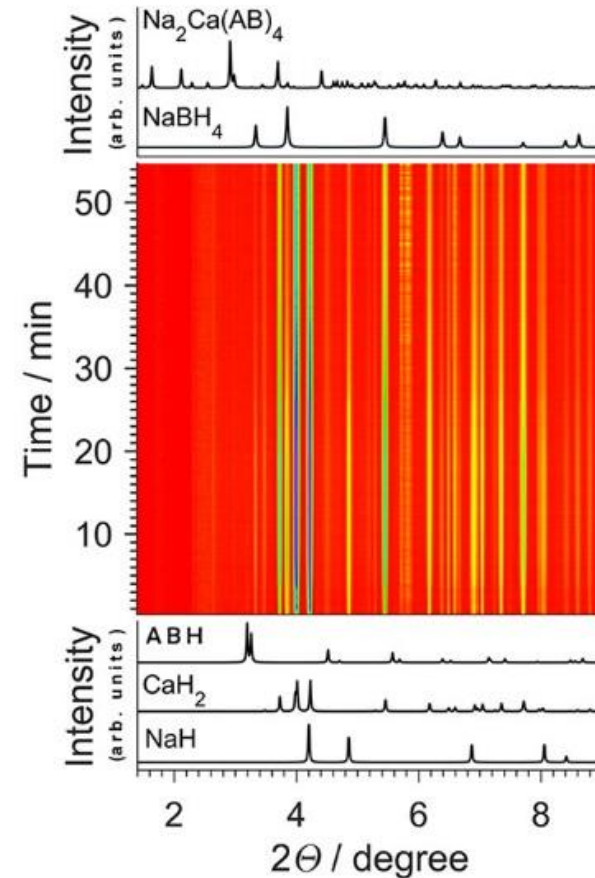
Zgrablić, Čapeta, Rakić et al. *PCCP* **27** (2025) 5909

CuBr₂ + 2CsCl

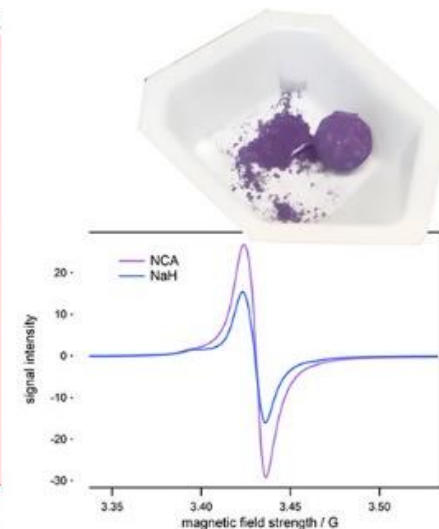




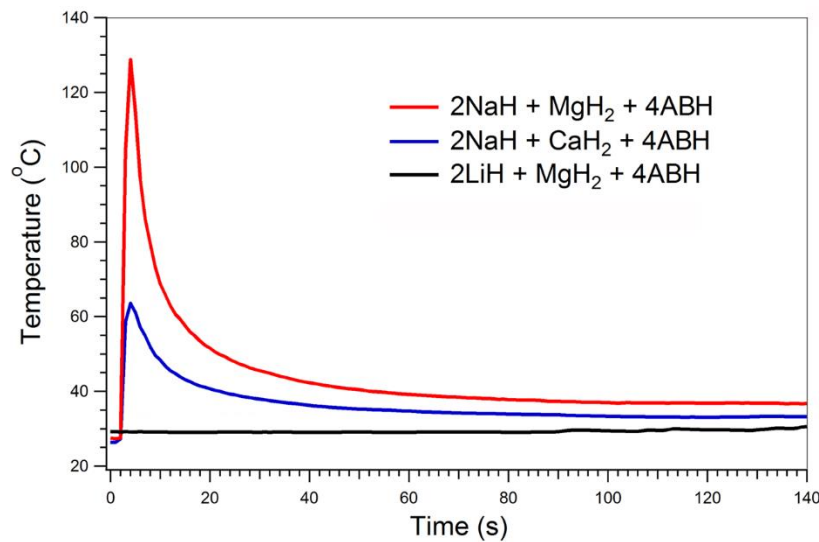
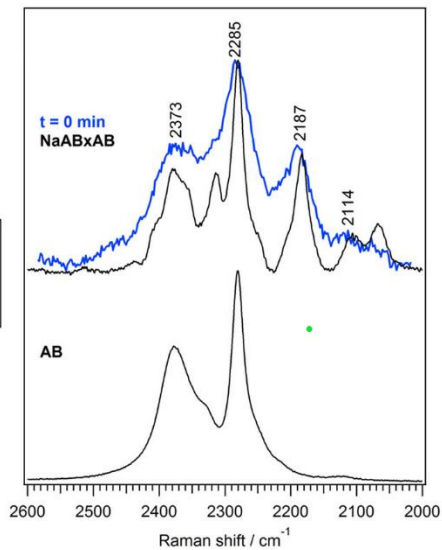
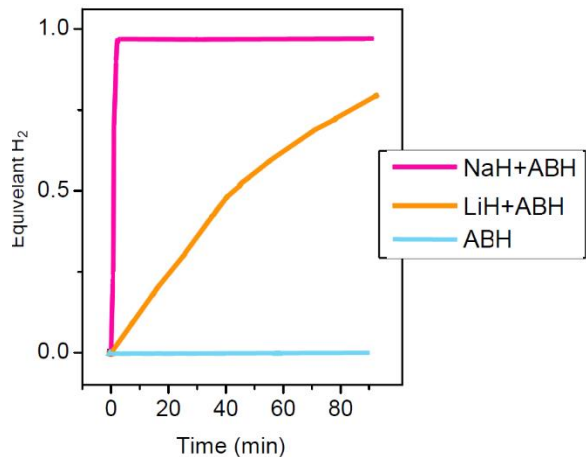
(a)



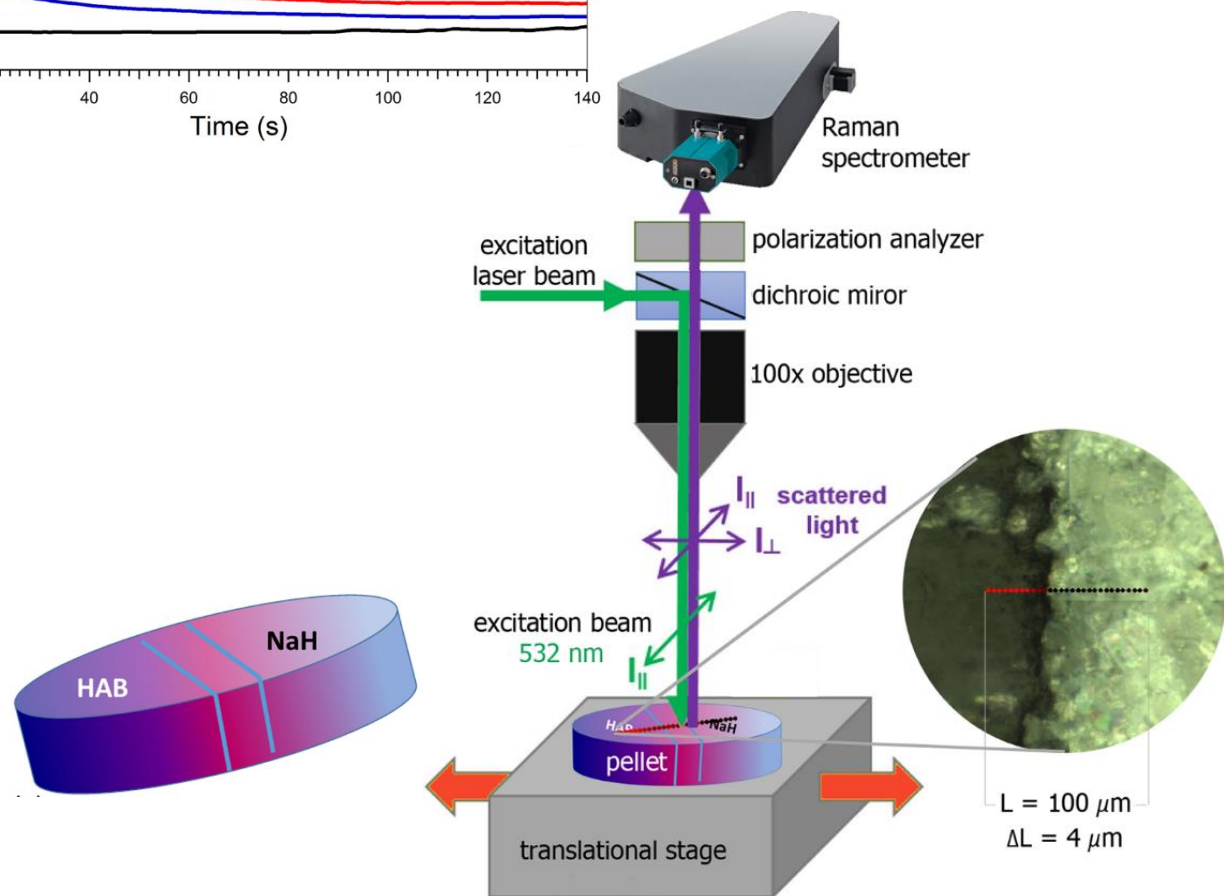
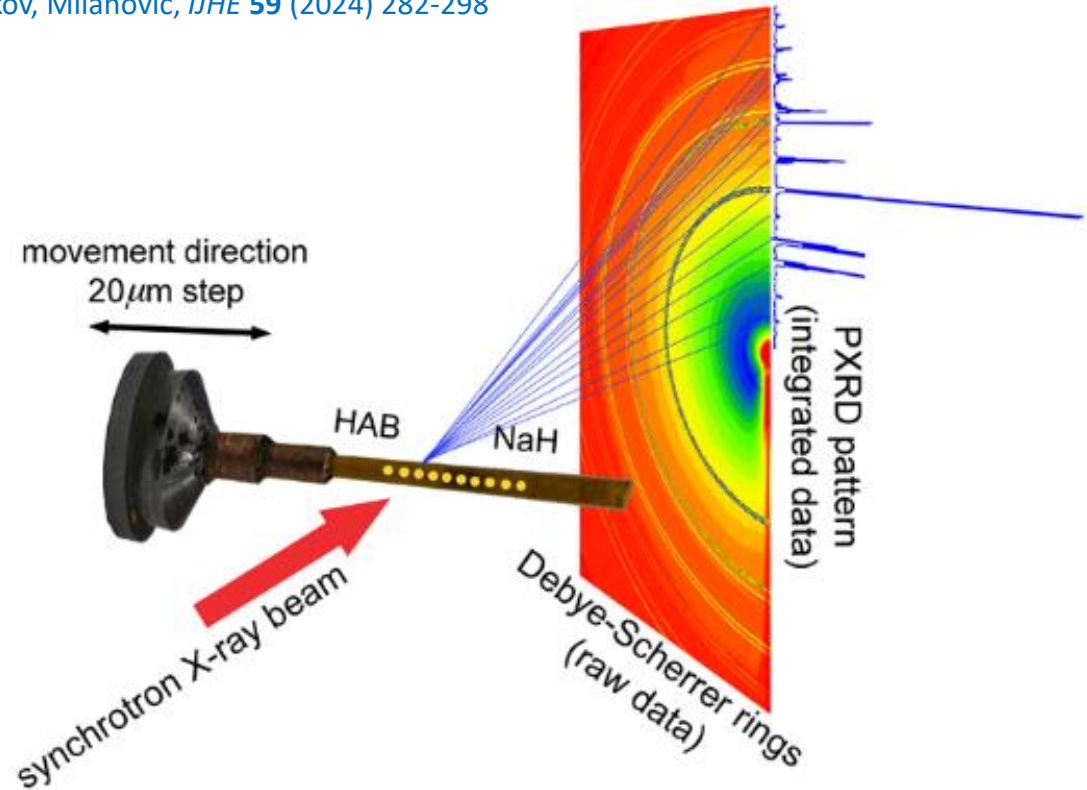
(b)

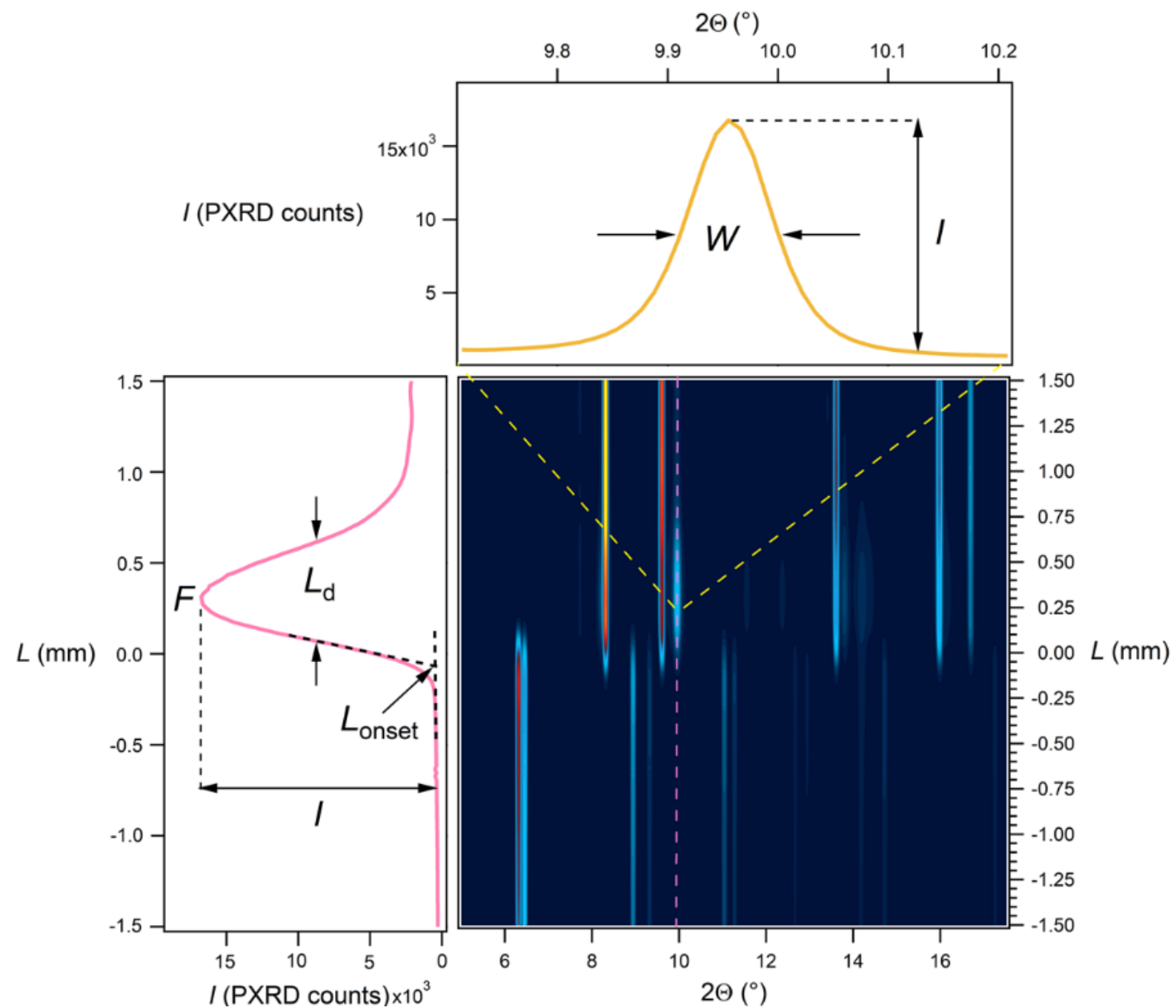
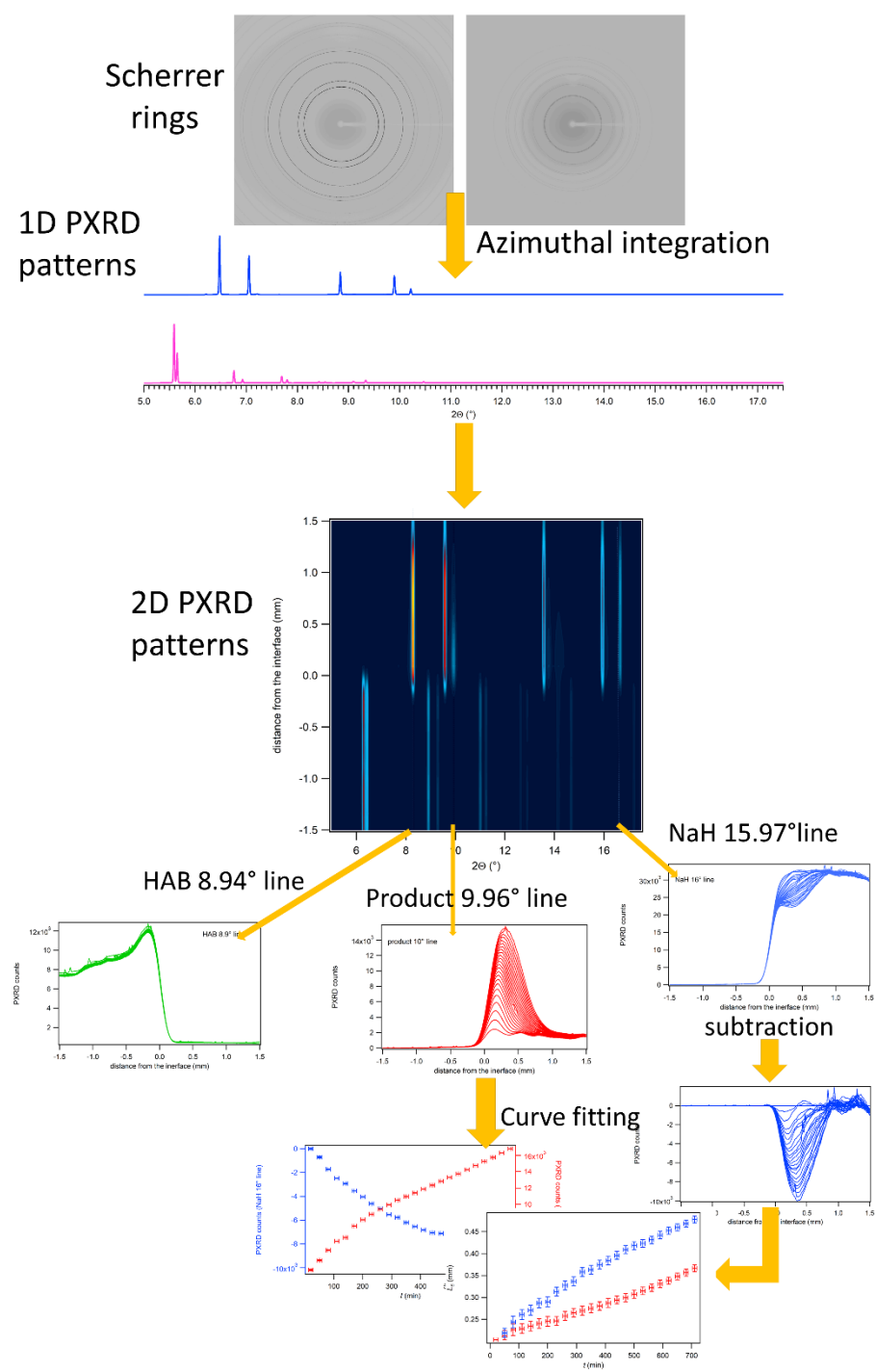


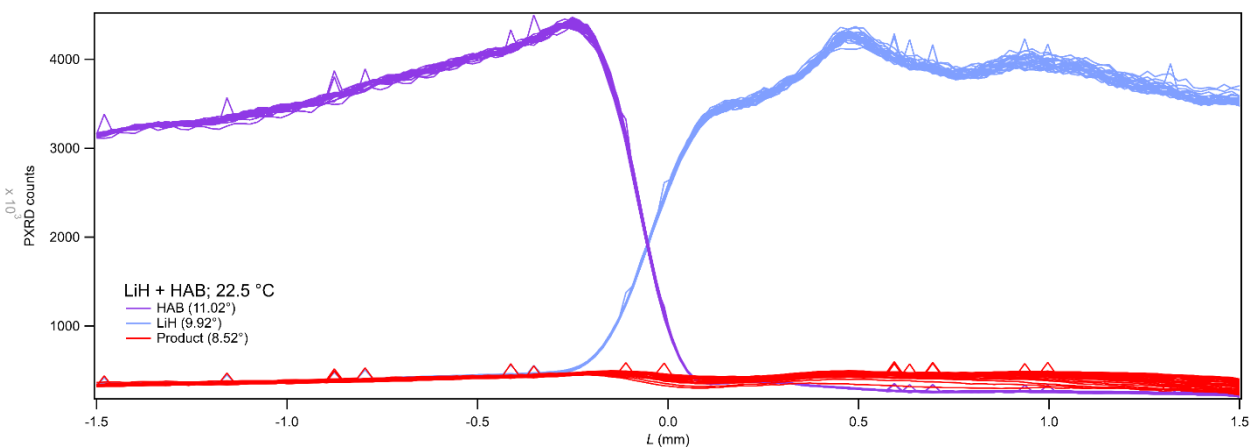
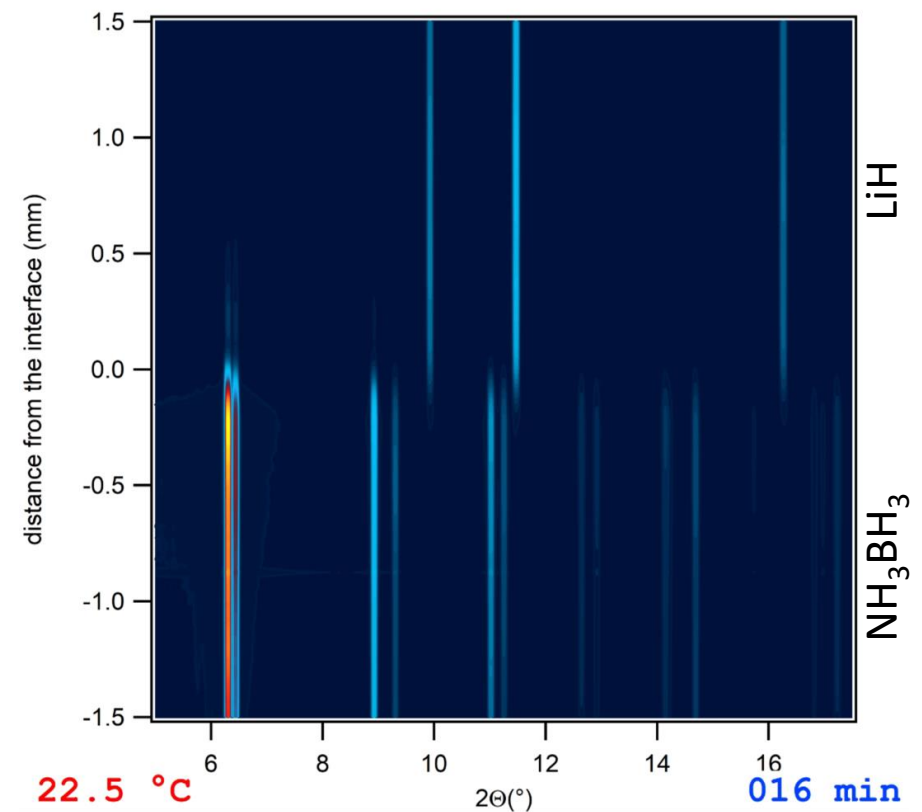
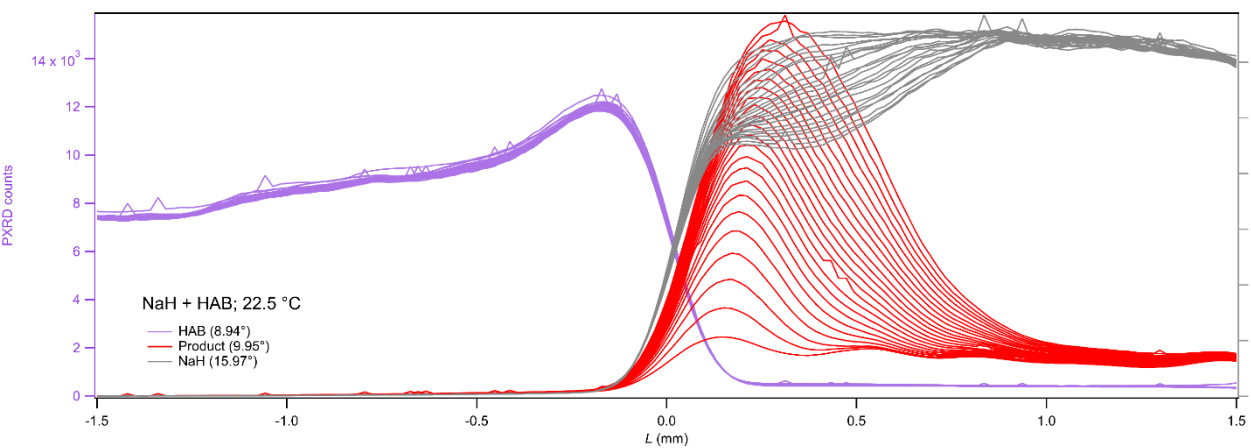
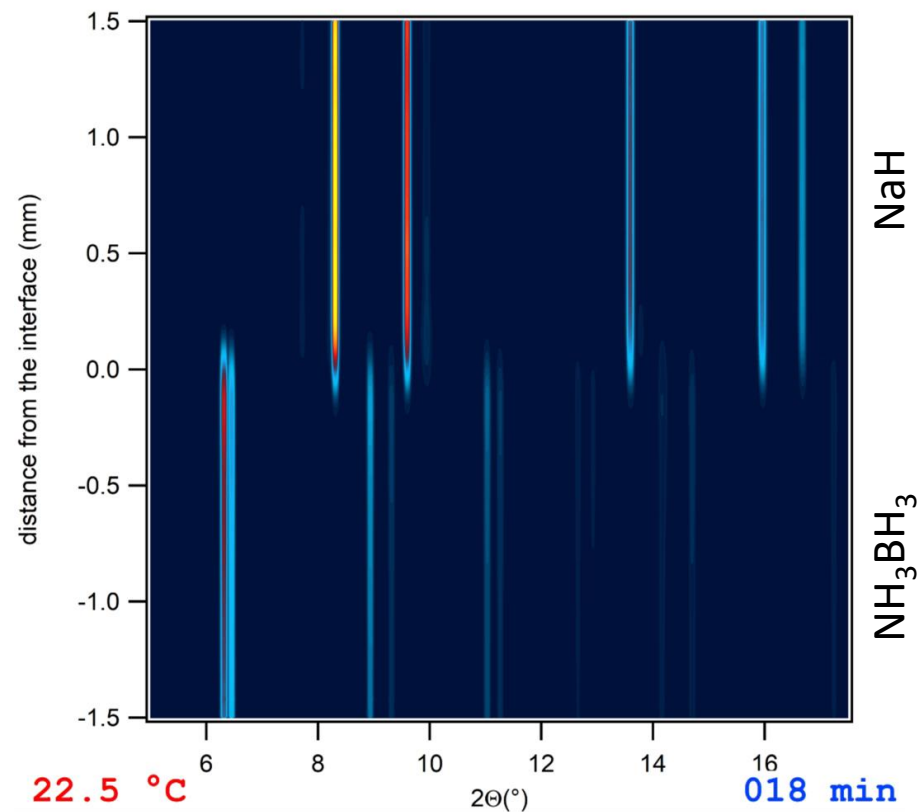
NaH + NH₃BH₃

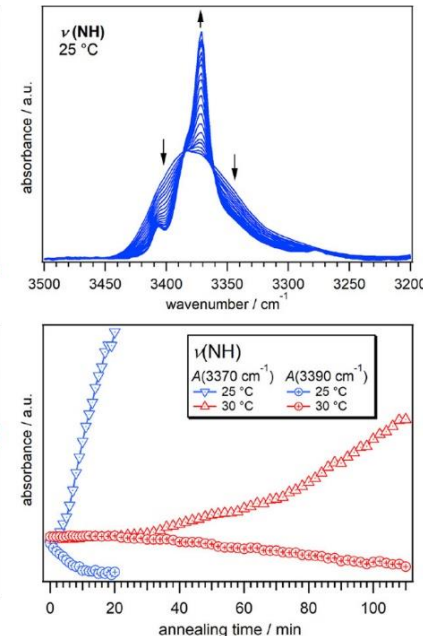
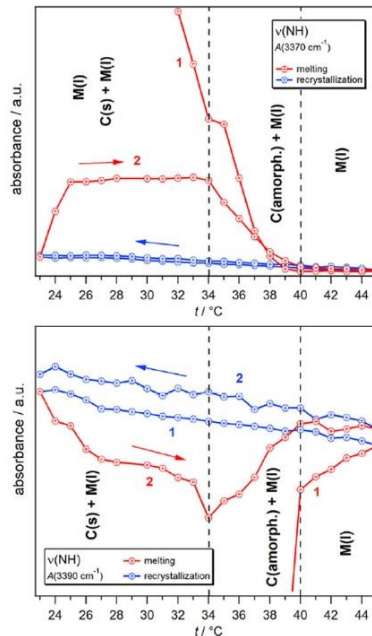
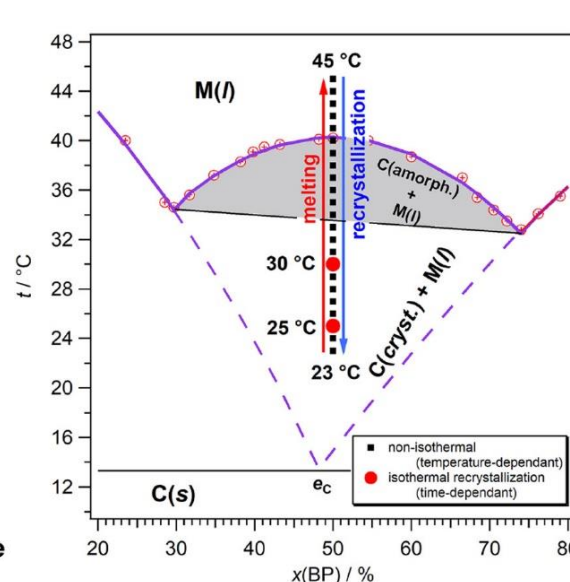
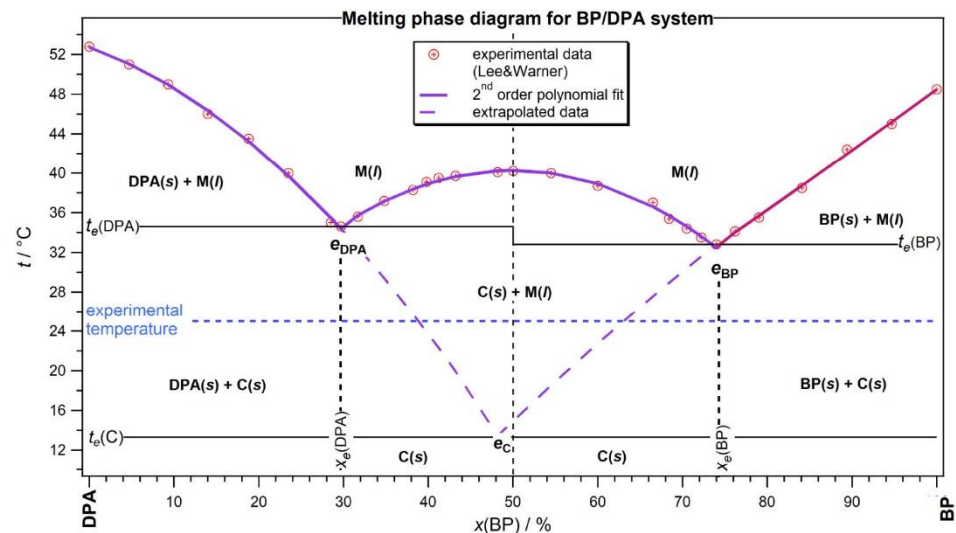
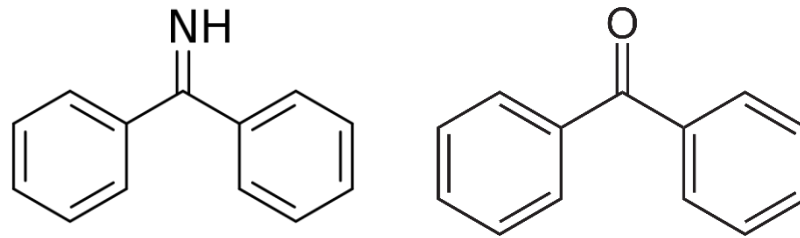


Biliškov, Milanović, *IJHE* 59 (2024) 282-298





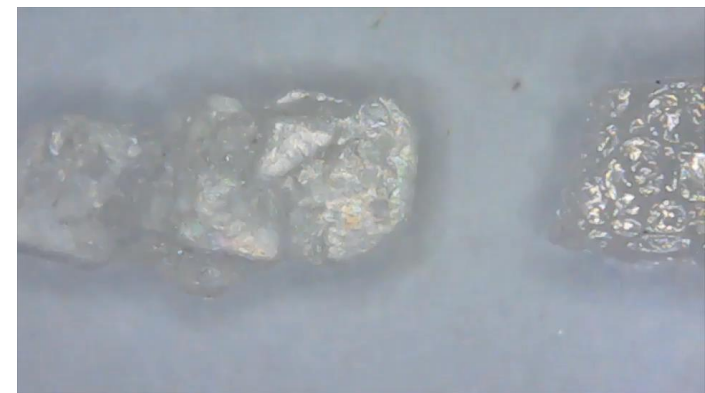
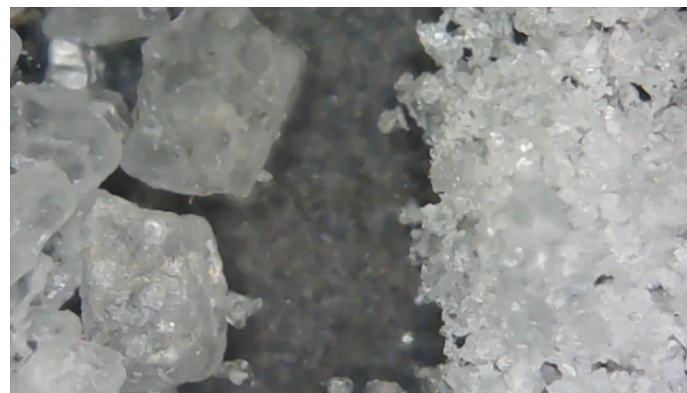
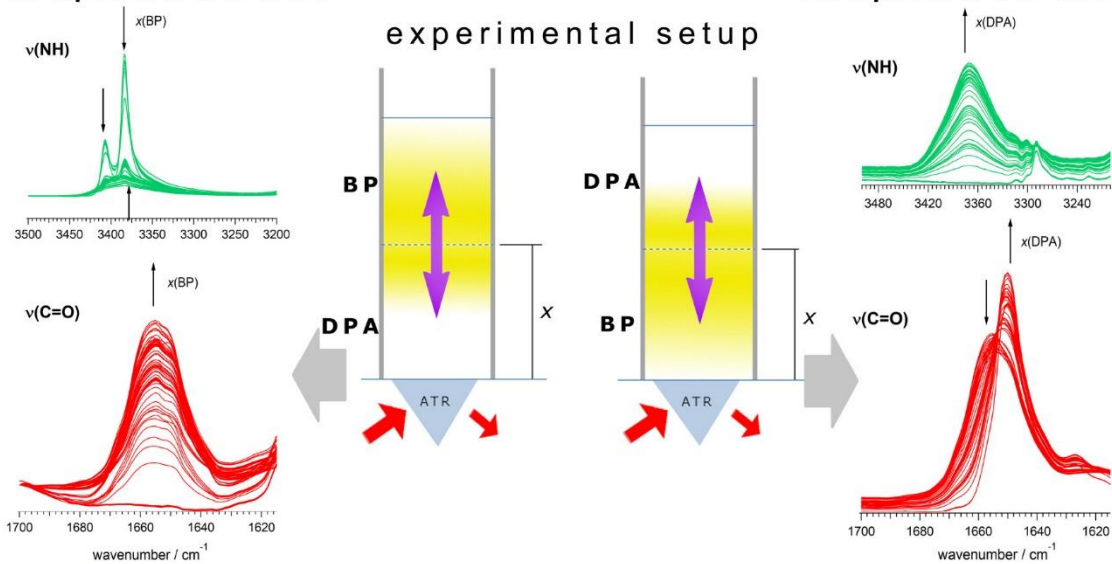


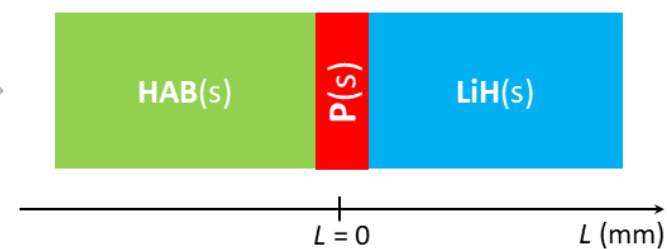
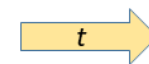
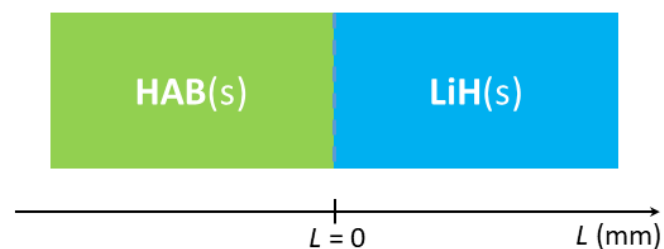
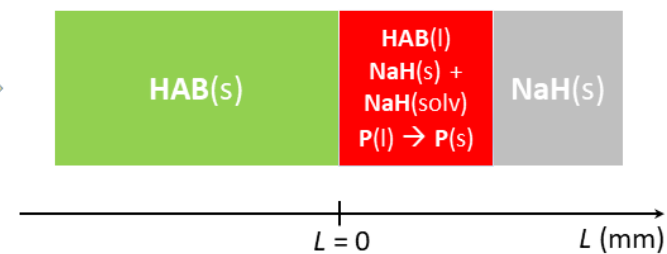
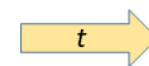
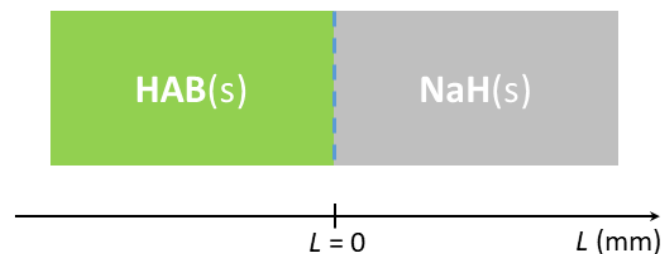
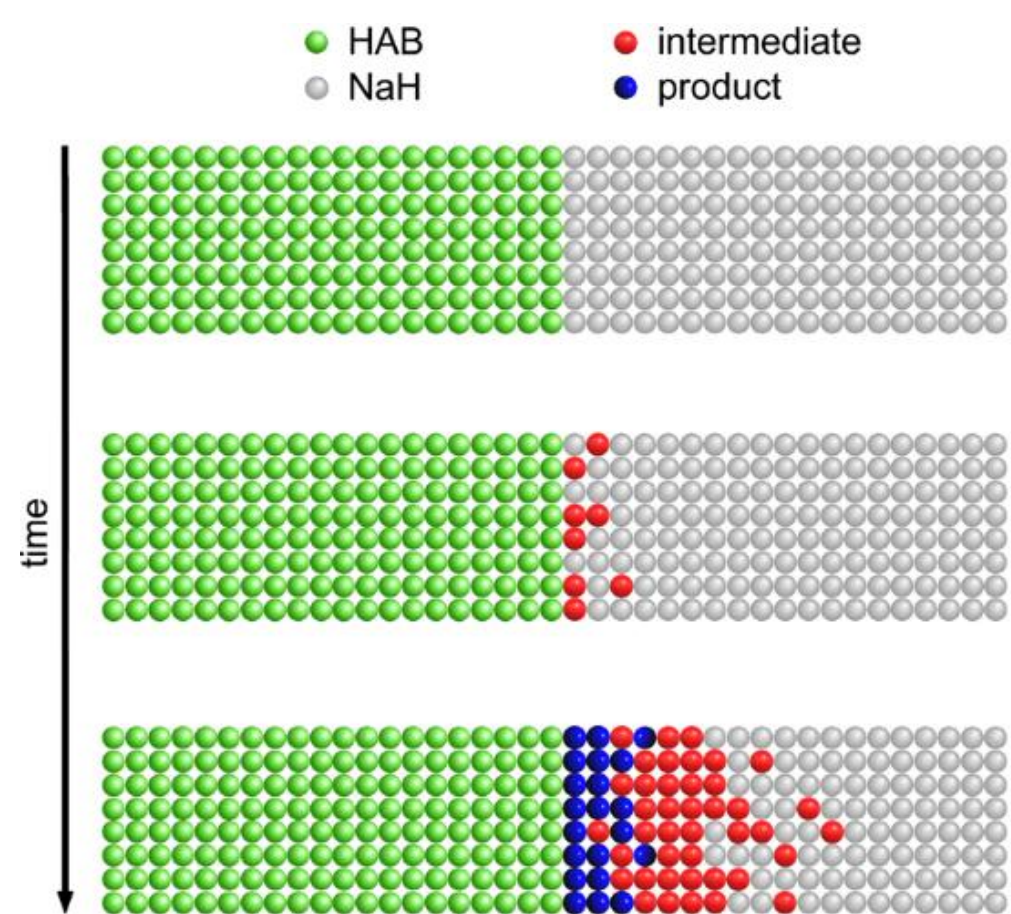


IR spectra vs. time

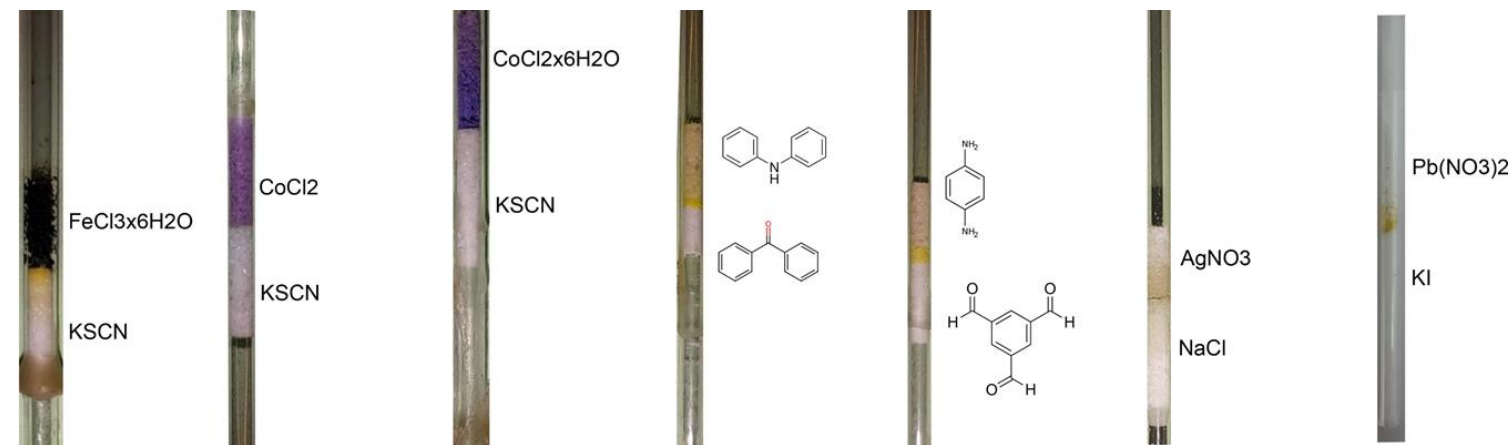
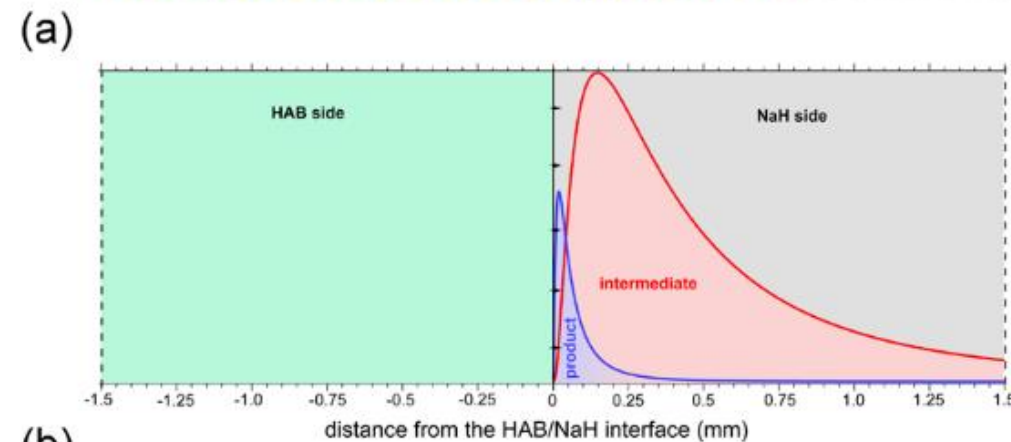
IR spectra vs. time

experimental setup





Systematic screening of inorganic and organic solid-state reactions (ongoing)



Thank you!



Srećko Kirin
Krunoslav Užarević
Ernest Sanders
Tomislav Mrla
Berislav Perić
Ivana Brekalo
Valentina Martinez
Emilija Petrović Hađar



McGill
UNIVERSITY



Goran Zgrablić
Igor Milanović
Katarina Batalović
Hatem Titi
Andreas Borgschulte



Martin Etter
Martin Aaskov
Ann-Christin Dippel
Jiatu Liu
Igor Milanović
Karol Fijalkowski
Wojciech Wegner



Graham King
Al Rahemtulla
Joe Marrett
Cameron Lennox



Save the date!

6th Solid-state Science and Research conference
Zagreb, June 2027
TBA



HRZZ

