FACULTY OF CHEMISTRY

ISI CAS Institute of Scientific Instruments The Czech Academy of Sciences

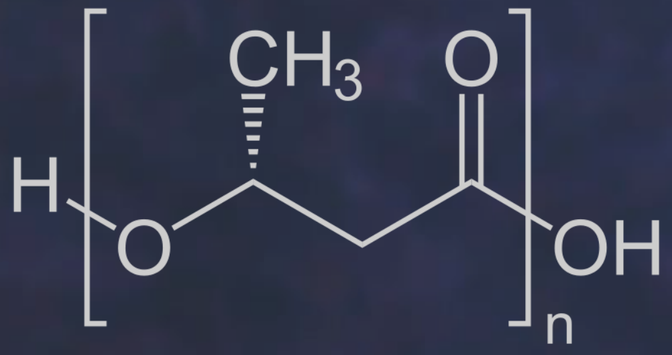
CTU CZECH TECHNICAL UNIVERSITY IN PRAGUE

Characterization of surface and mechanical properties of microbial cells

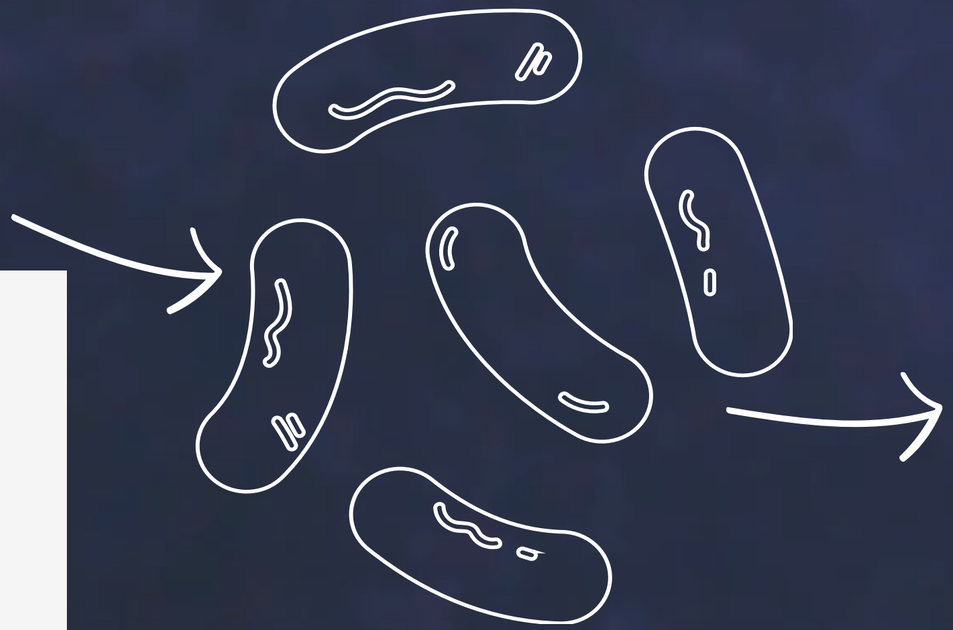
Markéta Khýrová

10. 6. 2024

INTRODUCTION

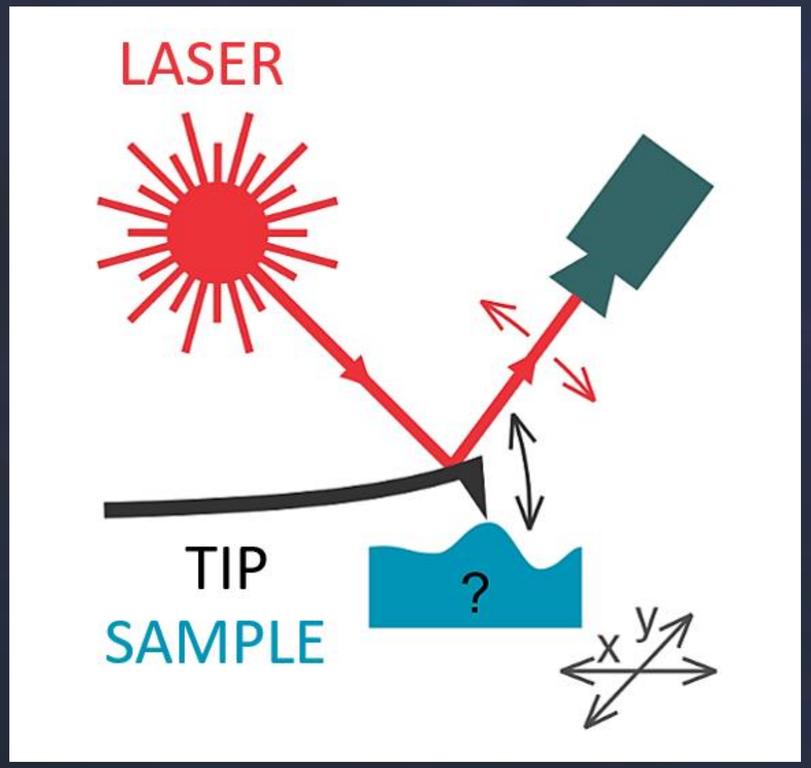


POLYHYDROXYALKANOATES
(PHA)

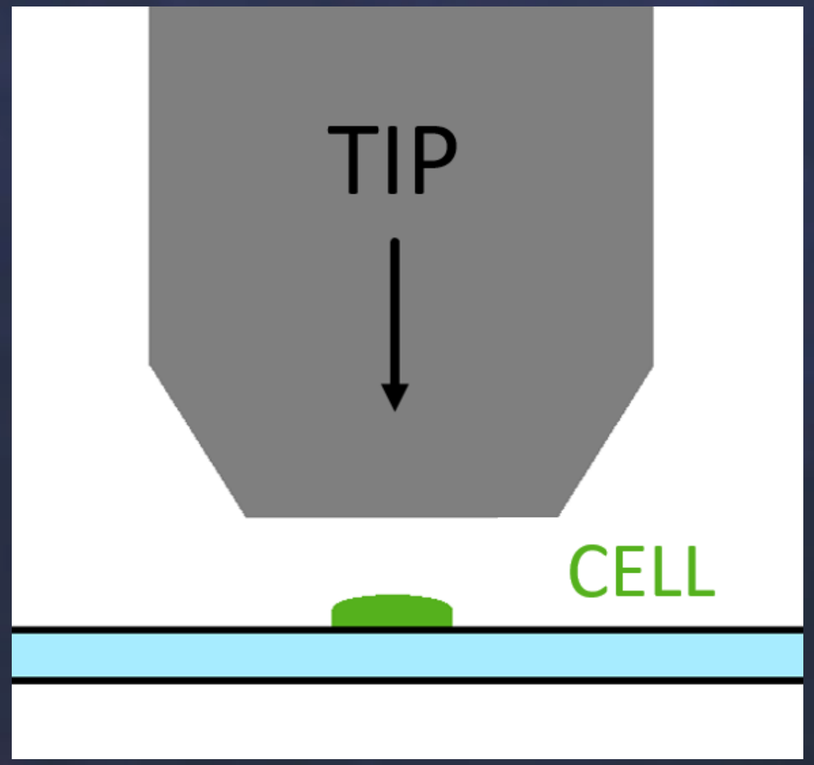


CHARACTERIZATION

MECHANICAL PROPERTIES

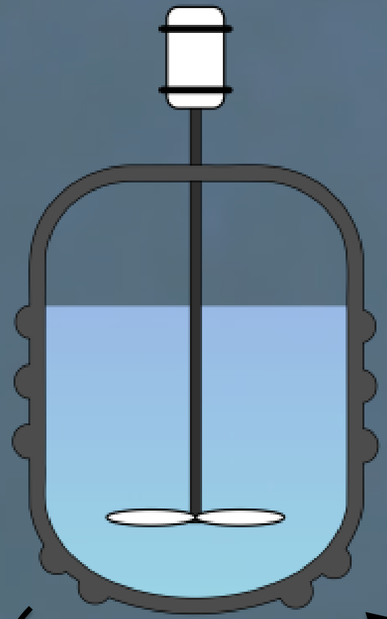


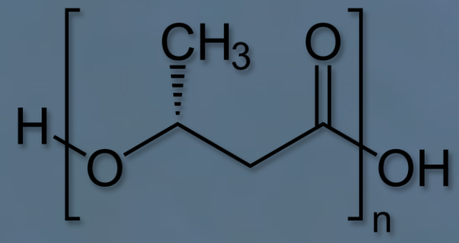
Atomic force microscope (AFM)



Nanoindenter (NI)

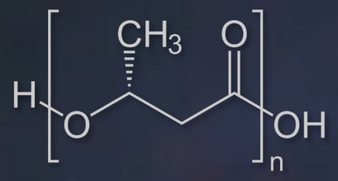
NUTRITION





POLYHYDROXYALKANOATES
(PHA)

NANOINDENTER (NI)
ATOMIC FORCE MICROSCOPE(AFM)



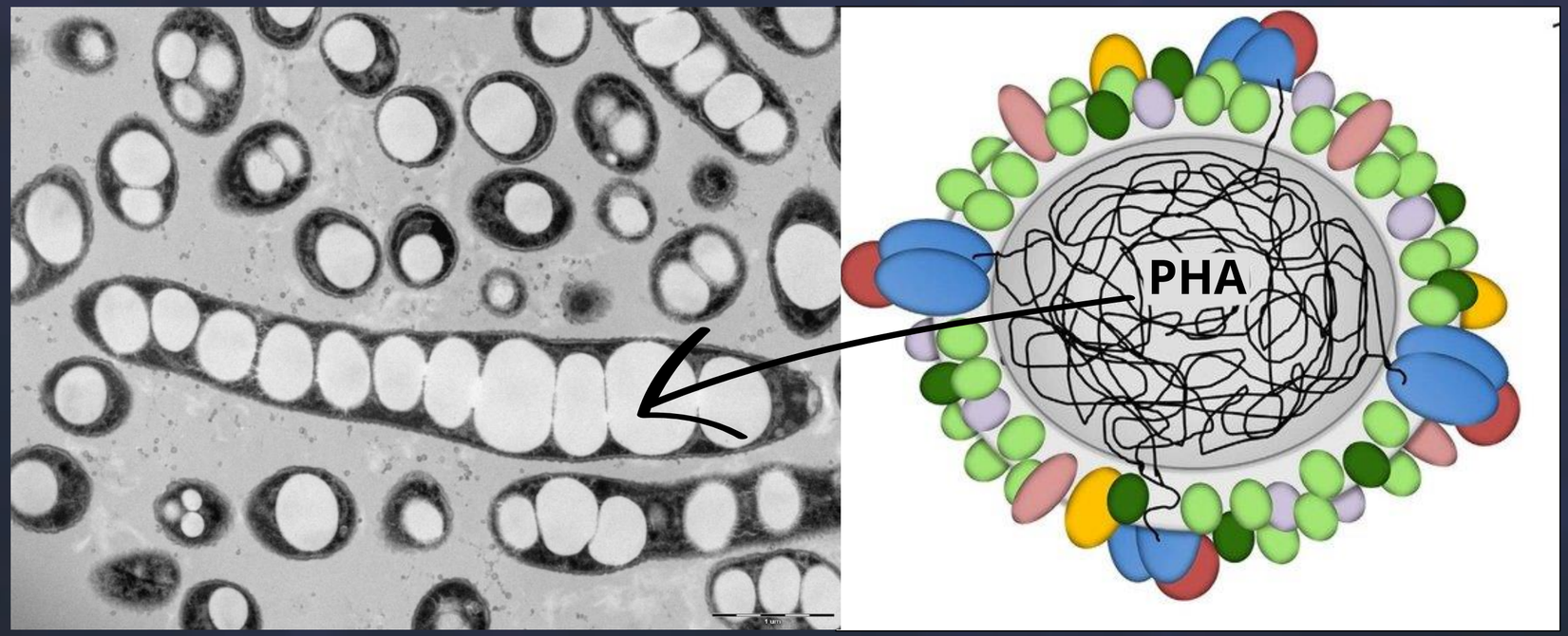
MODEL MICROORGANISMS

PRODUCERS OF PHAs

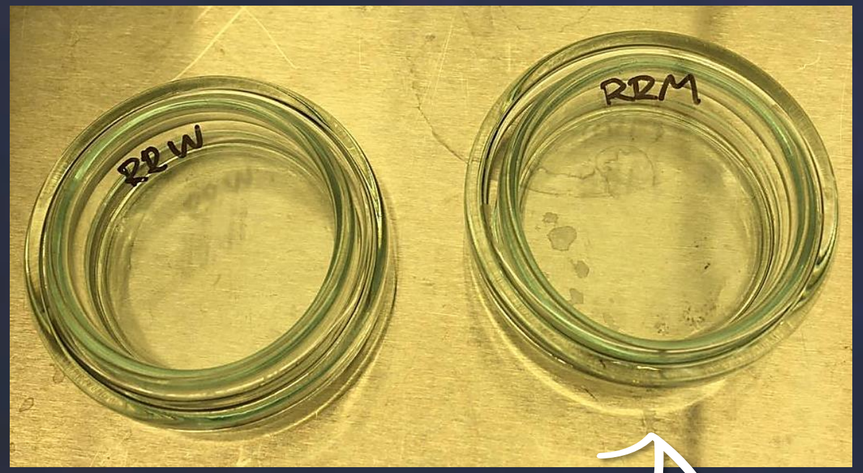
- *Cupriavidus necator* H16 (CCM 3726)
- *Rhodospirillum rubrum* (DMS 467)

NON-PRODUCERS (MUTANTS) OF PHAs

- *Cupriavidus necator* PHB^{-4} (DSM 514)
- *Rhodospirillum rubrum* Δ*phaC* (DMS 467)

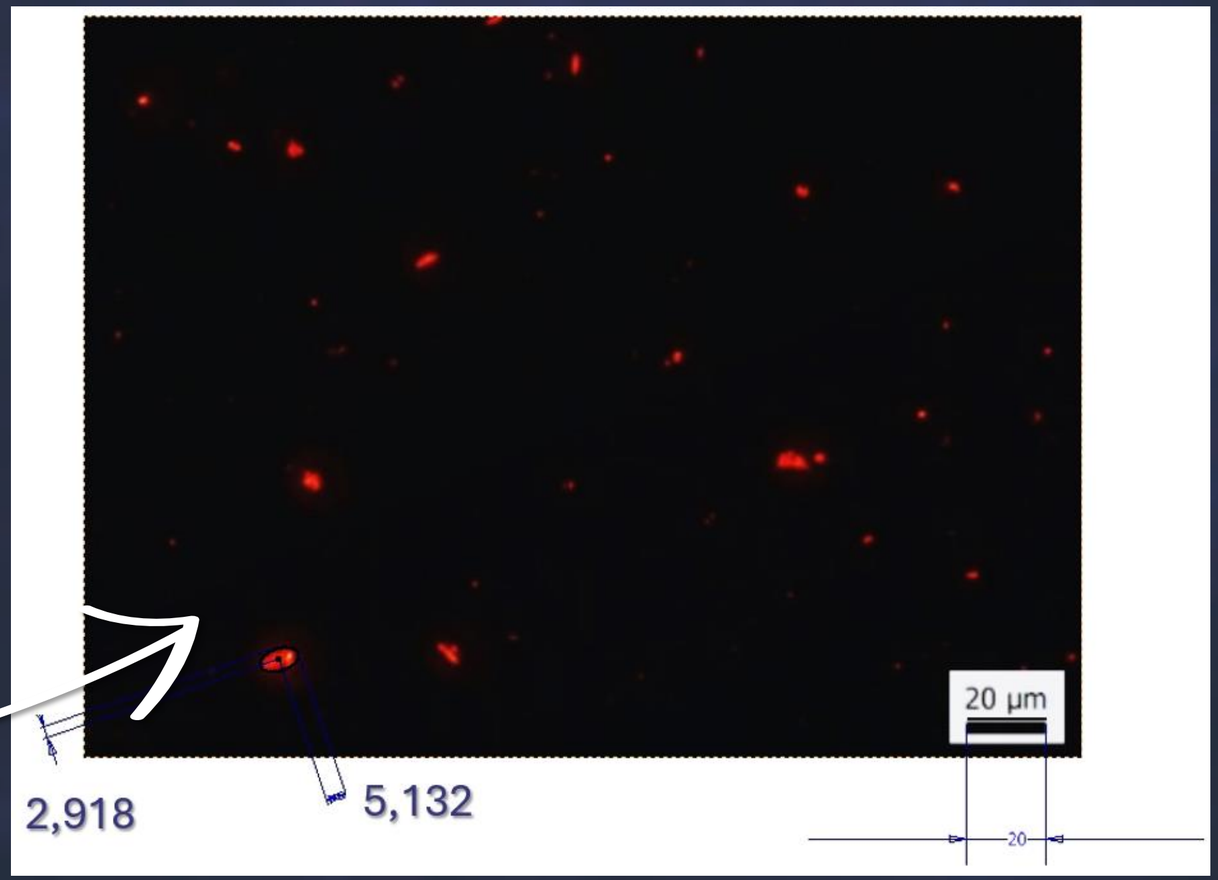


SAMPLE PREPARATION



POLY-L-LYSINE

BODIPY 493/503



AFM

NANOINDENTER

QI MODE

SETTING

10 μm/s APPROACH

MLCT – A

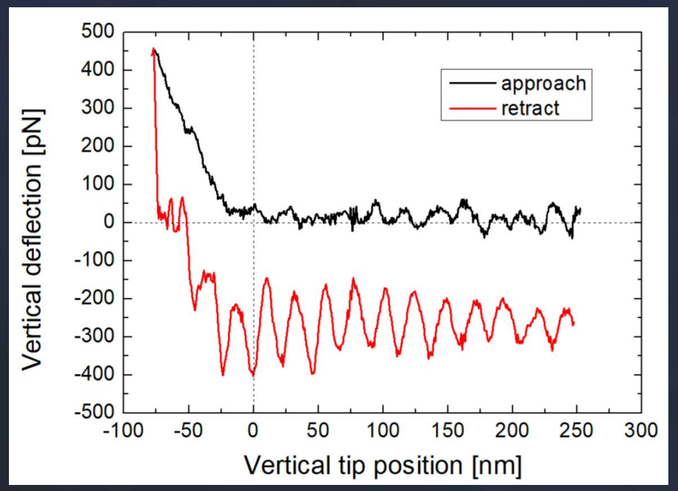
TIP

FLAT PUNCH (Ø 20 μm)

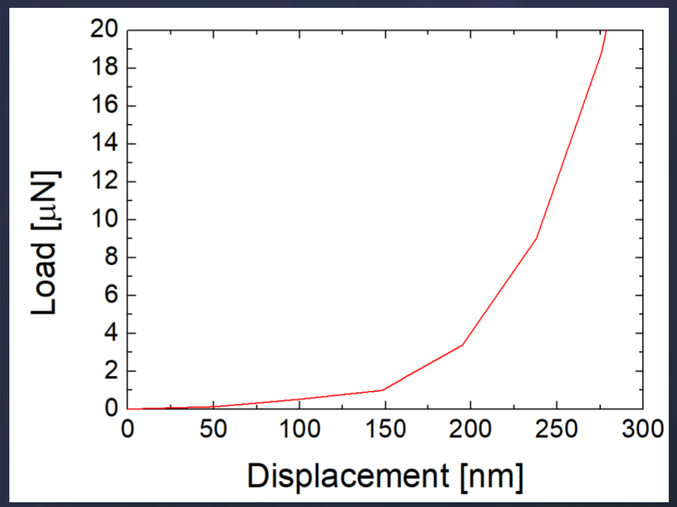
HERZT MODEL

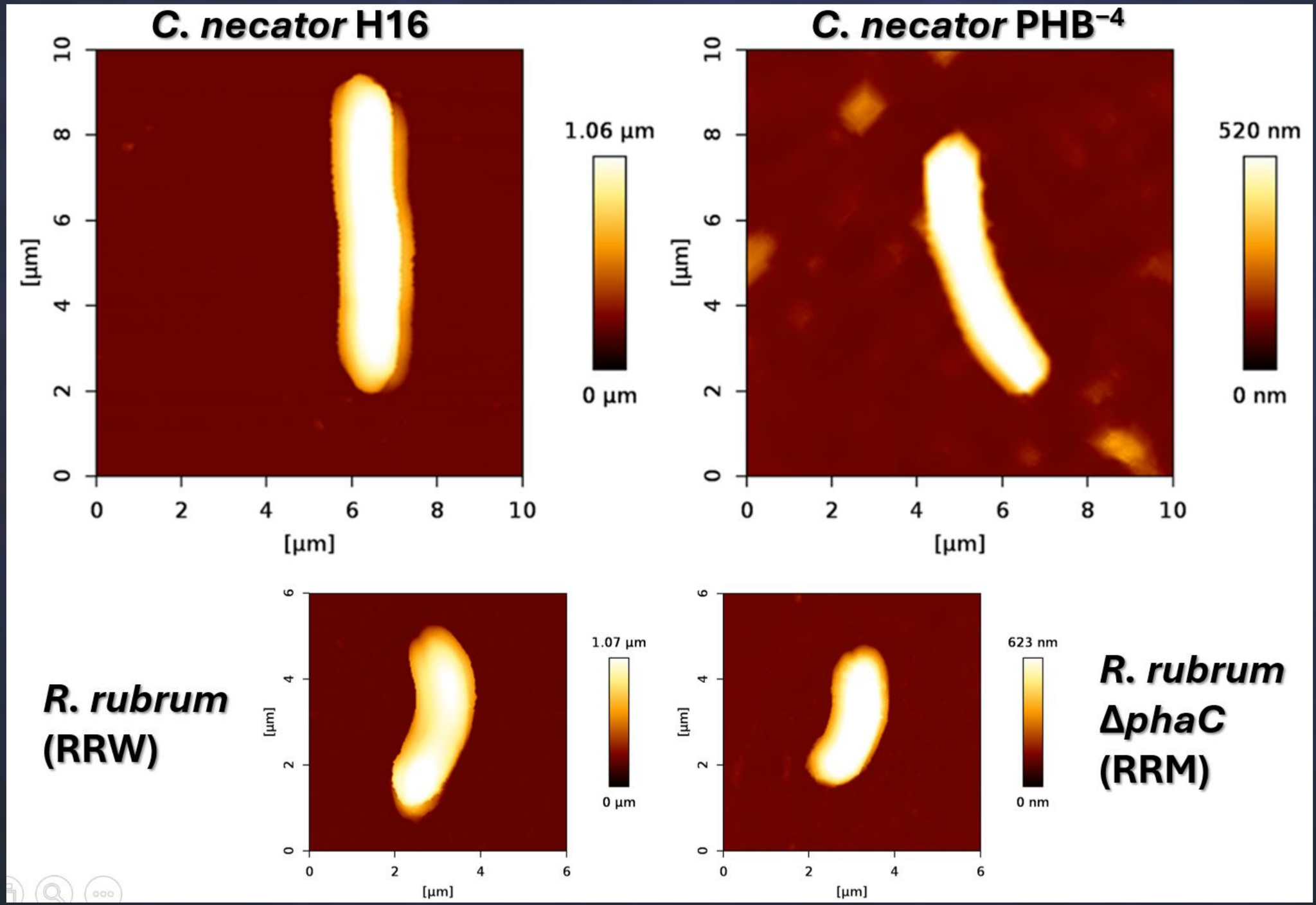
ANALYTICAL MODEL

OVERBECK MODEL



CURVES




C. necator H16
C. necator PHB⁻⁴
1.06 µm
0 µm
520 nm
0 nm
[µm]
0
2
4
6
8
10
R. rubrum (RRW)
1.07 µm
623 nm
R. rubrum ΔphaC (RRM)

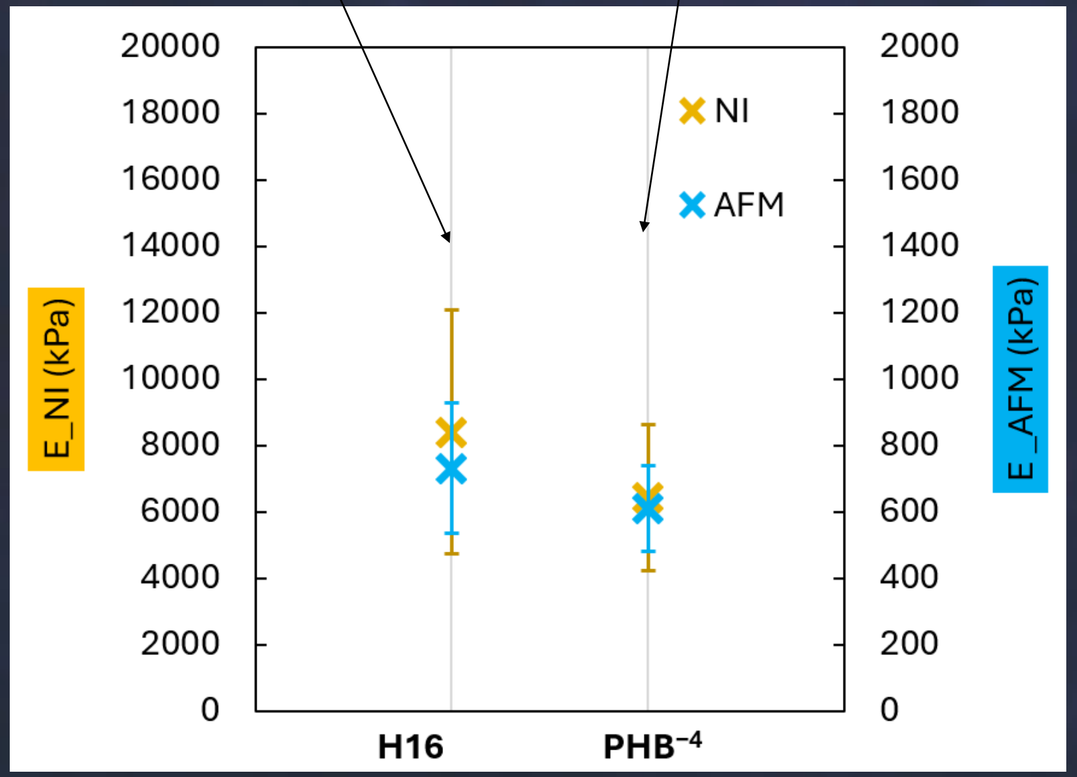
YOUNG'S MODULUS

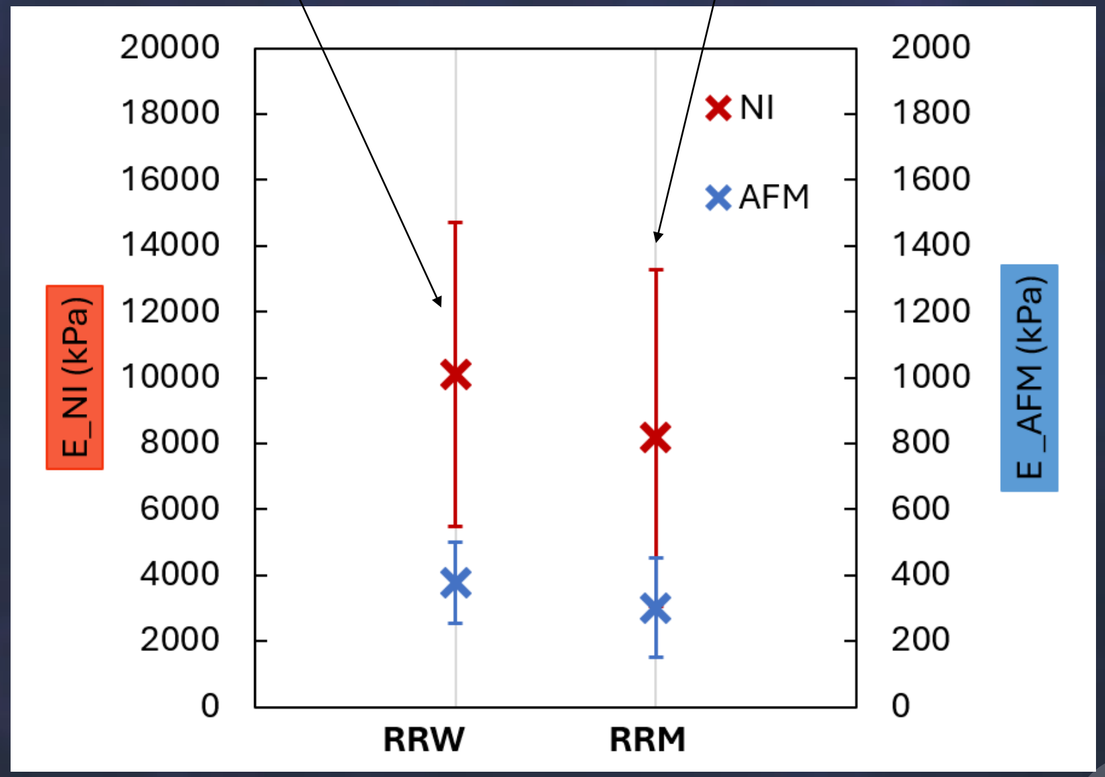
C. necator H16

C. necator PHB^{-4}

R. rubrum

R. rubrum ΔphaC





AFM – ATOMIC FORCE MICROSCOPE
NI - NANOINDENTER

SUMMARY

PROMISING TECHNIQUES FOR MECHANICAL CHARACTERIZATION OF PHA PRODUCING BACTERIA:

- ATOMIC FORCE MICROSCOPE
- NANOINDENTER

AFM

PHA PRODUCING X NON-PRODUCING BACTERIA

- SIGNIFICANT TOPOGRAPHICAL DIFERENCES
- SIGNIFICANT MECHANICAL DIFERENCES

NI

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