

Adsorption of Pentacene on Epitaxial Graphene and BN

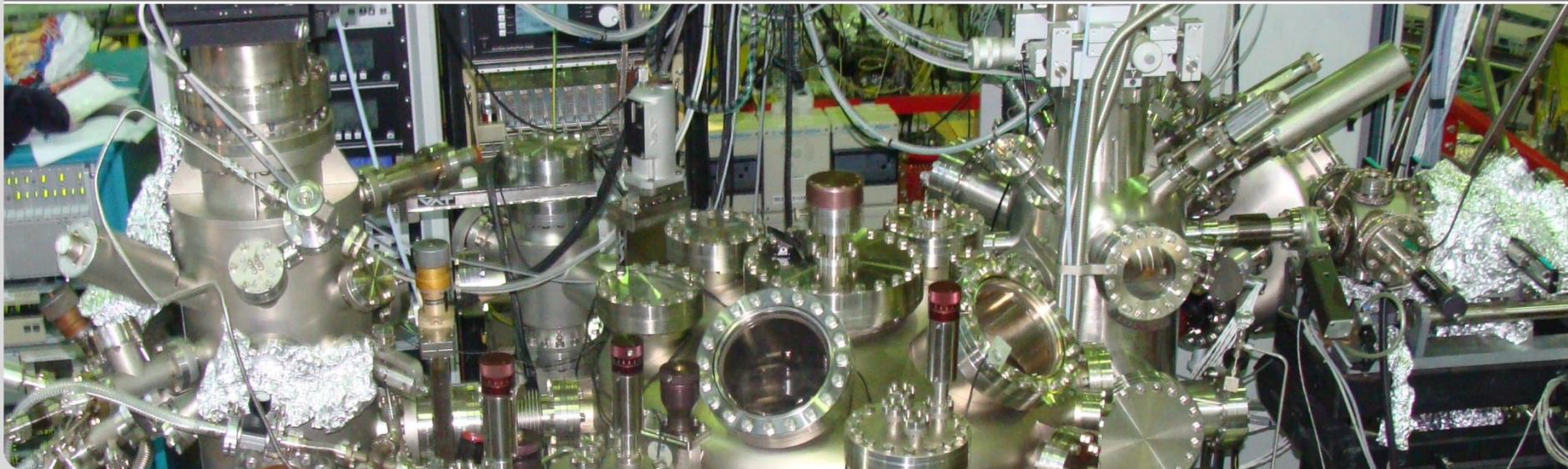
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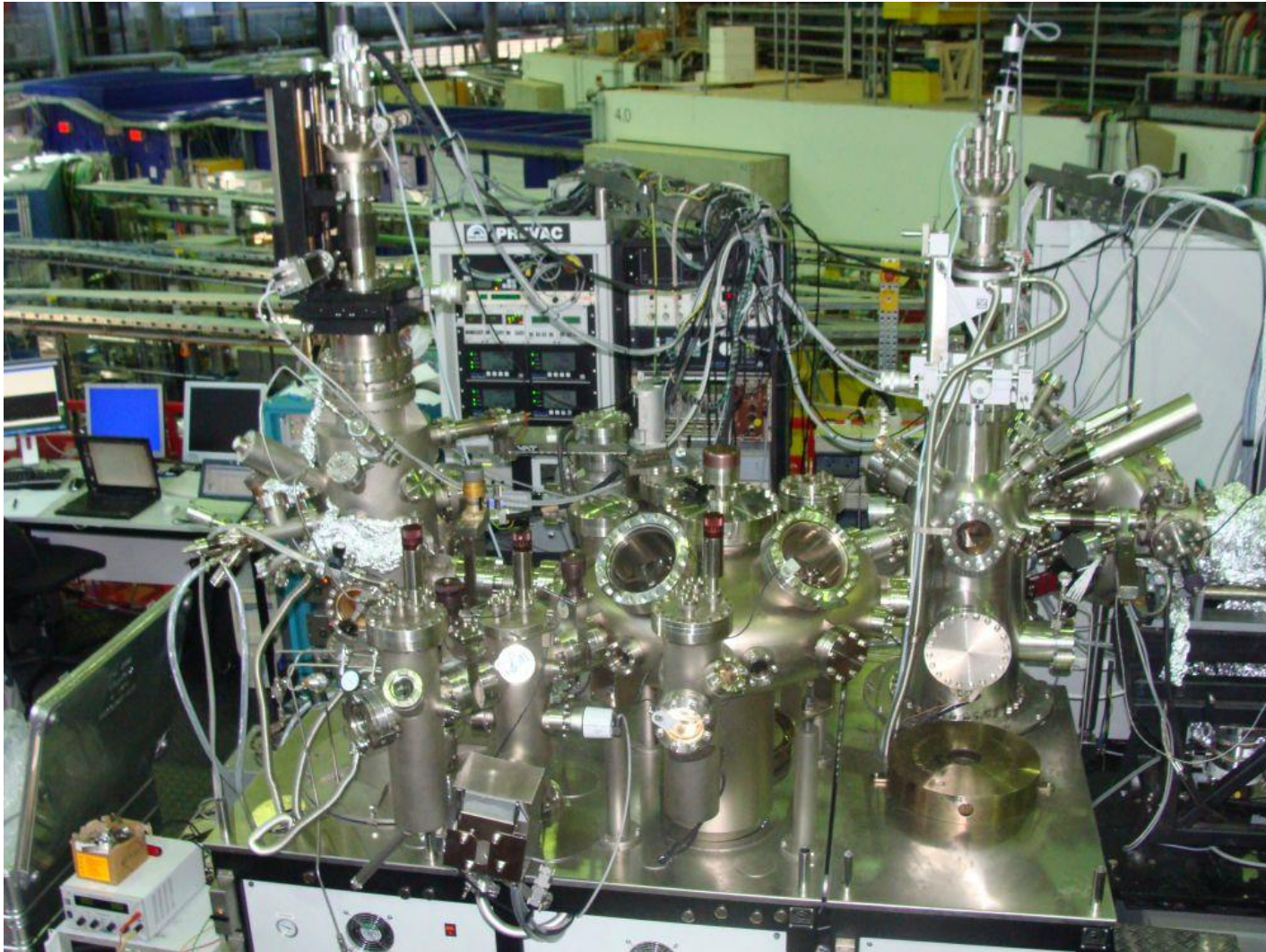
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Motivation

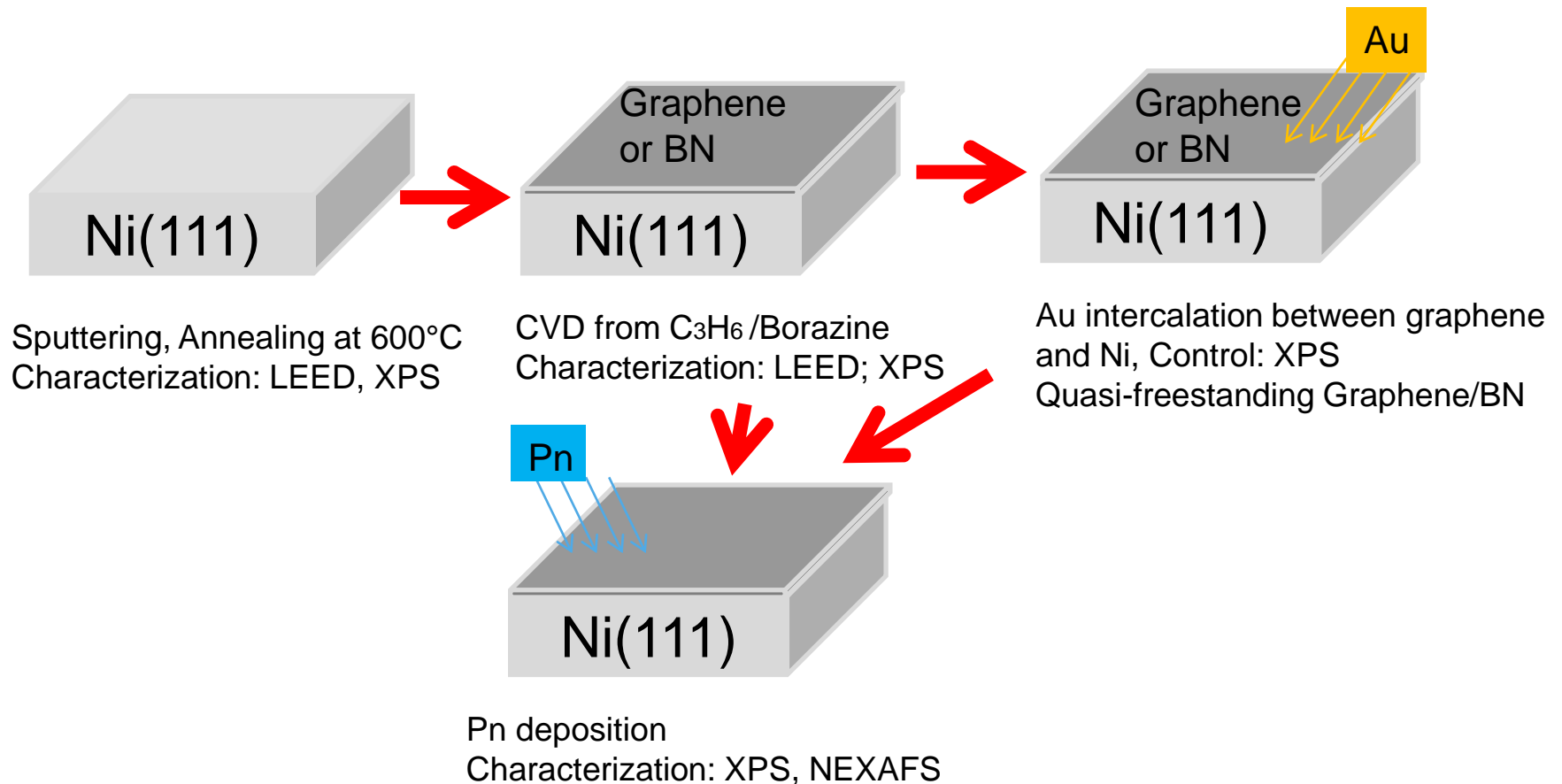
- Pentacene and graphene are promise candidates for organic electronics:
 - behaviour on the interface between them is very important
 - flat orientation of the first pentacene layer is necessary
- Fundamental understanding of the interaction on graphene/metal interface:
 - „weak“ or „strong“ (Gaede PrizeTalk of Yu. Dedkov)
 - Pentacene as a probe molecule
 - Comparison of EG/Ni(111) vs. EG/Au/Ni(111) and h-BN/Au/Ni(111)
- Possible interaction of pentacene with metal substrate through graphene - ?
Presence of „surface phase“ similar to chemisorbed pentacene on Ag(111)
[Käfer *et al*, *CPL*, **442** (2007) 376–383]
- Additional challenge:
Evaluation of C *K*-edge NEXAFS spectra for organic/graphene systems

XPS/NEXAFS endstation @ HESGM (BESSY II)



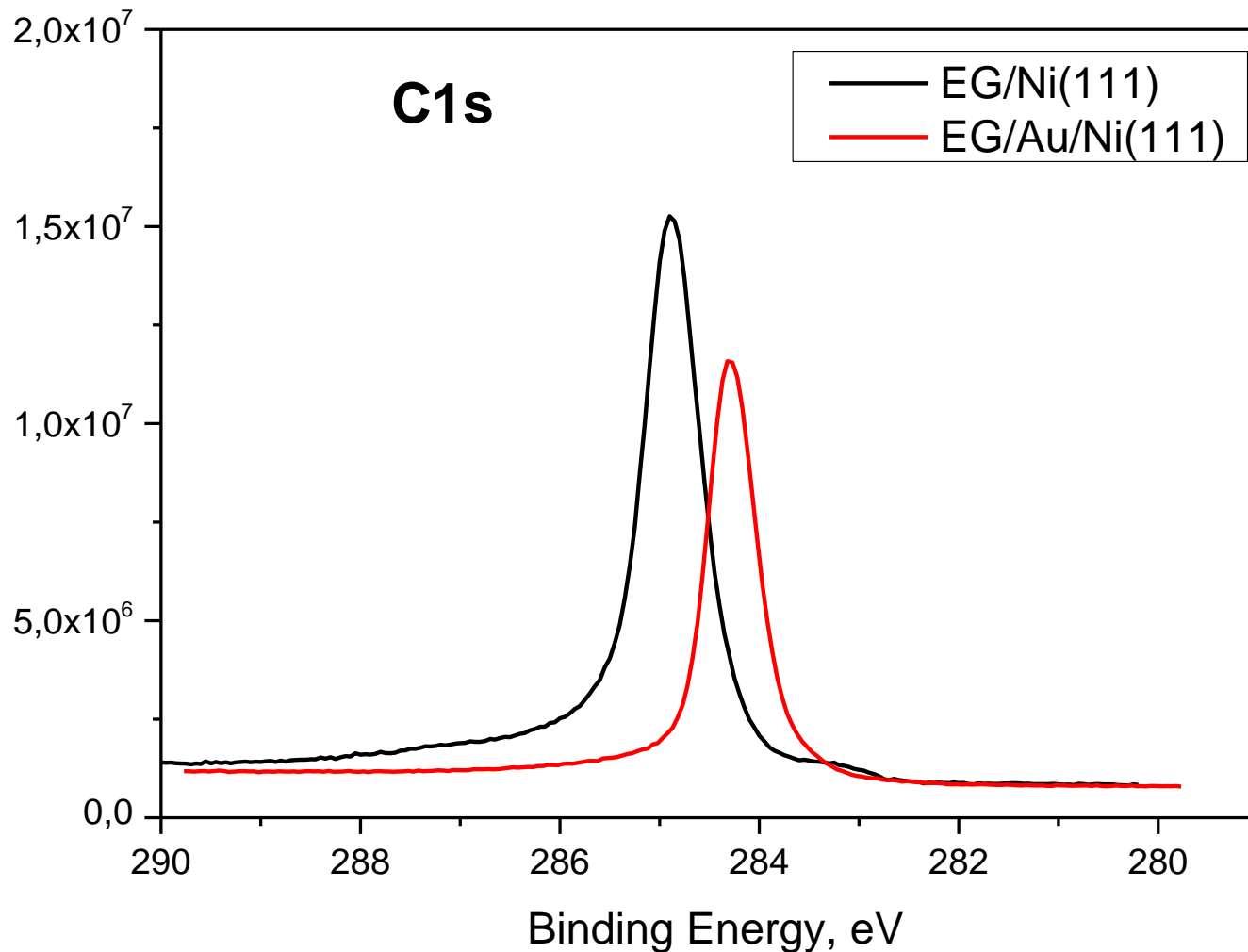
Sample preparation and layout of the experiment

Used systems: EG/Ni(111), EG/Au/Ni(111) and h-BN/Au/Ni(111)

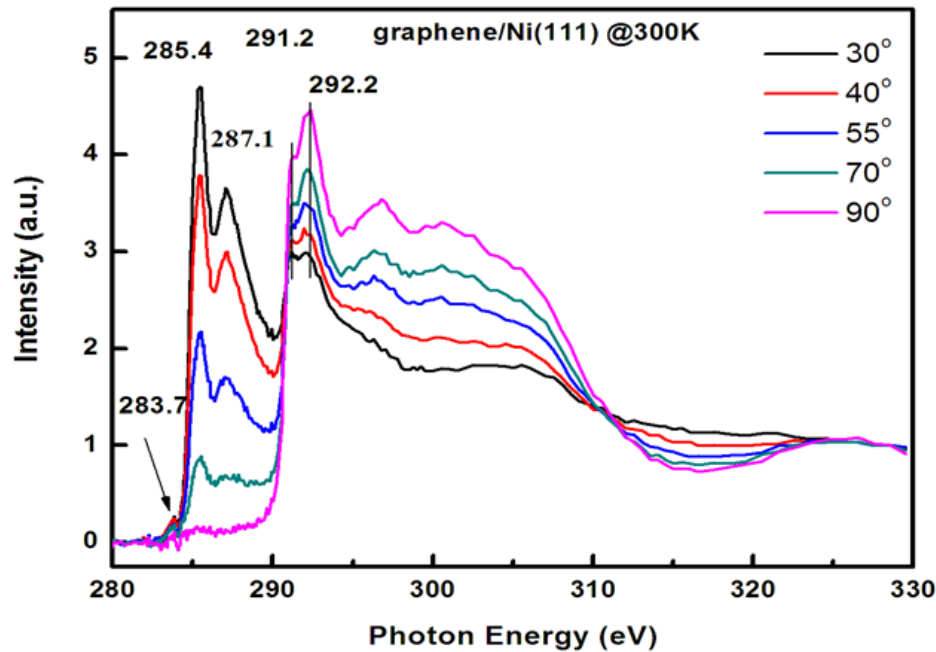


Pn thickness calibration with QCM

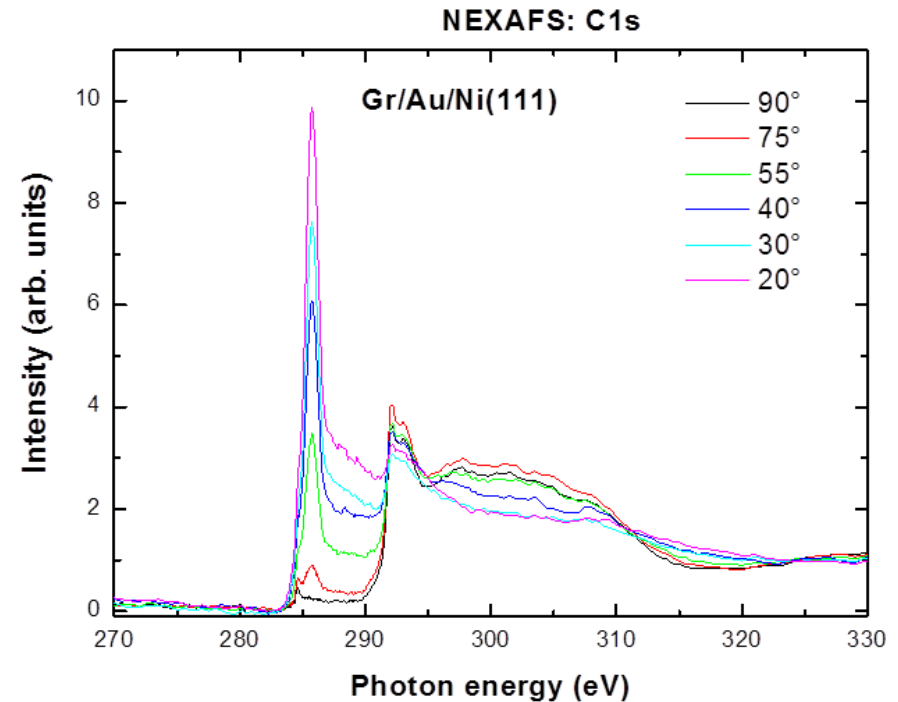
XPS: Shift of C1s line after Au intercalation



NEXAFS: Comparison of EG/Ni and EG/Au/Ni

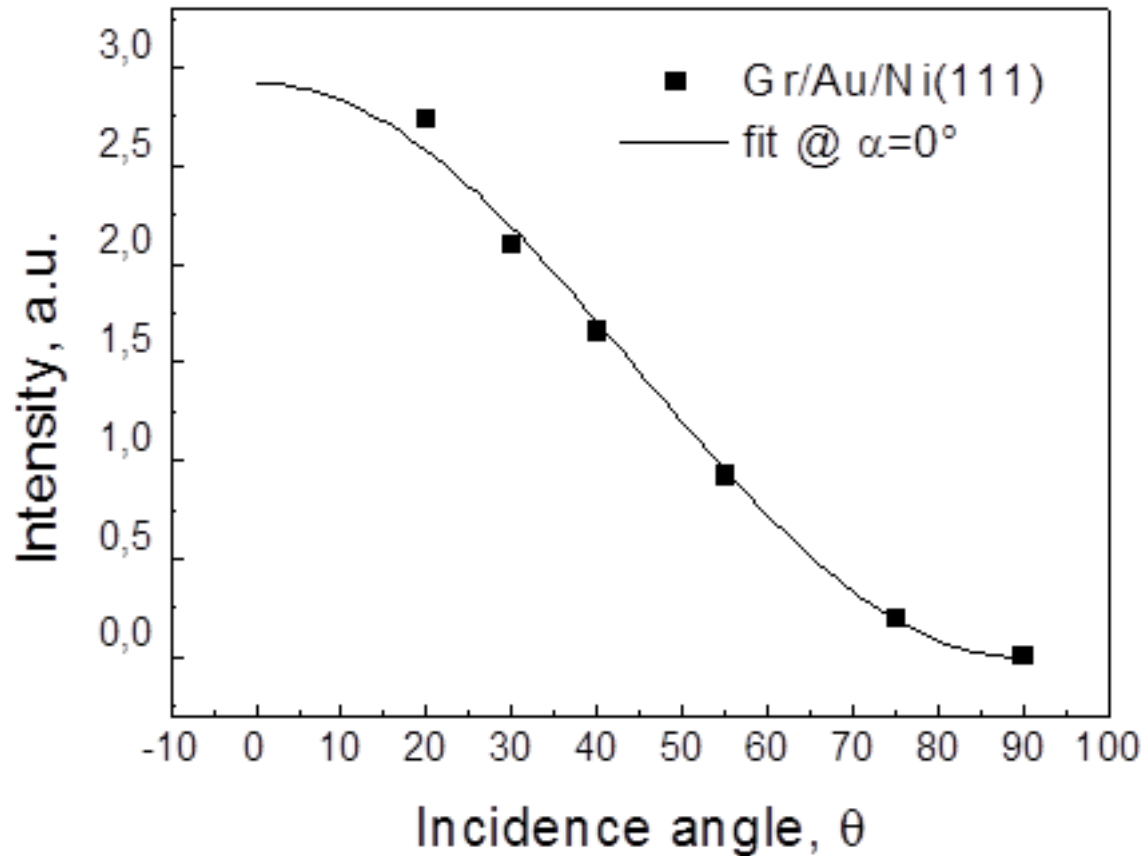


„Strong“



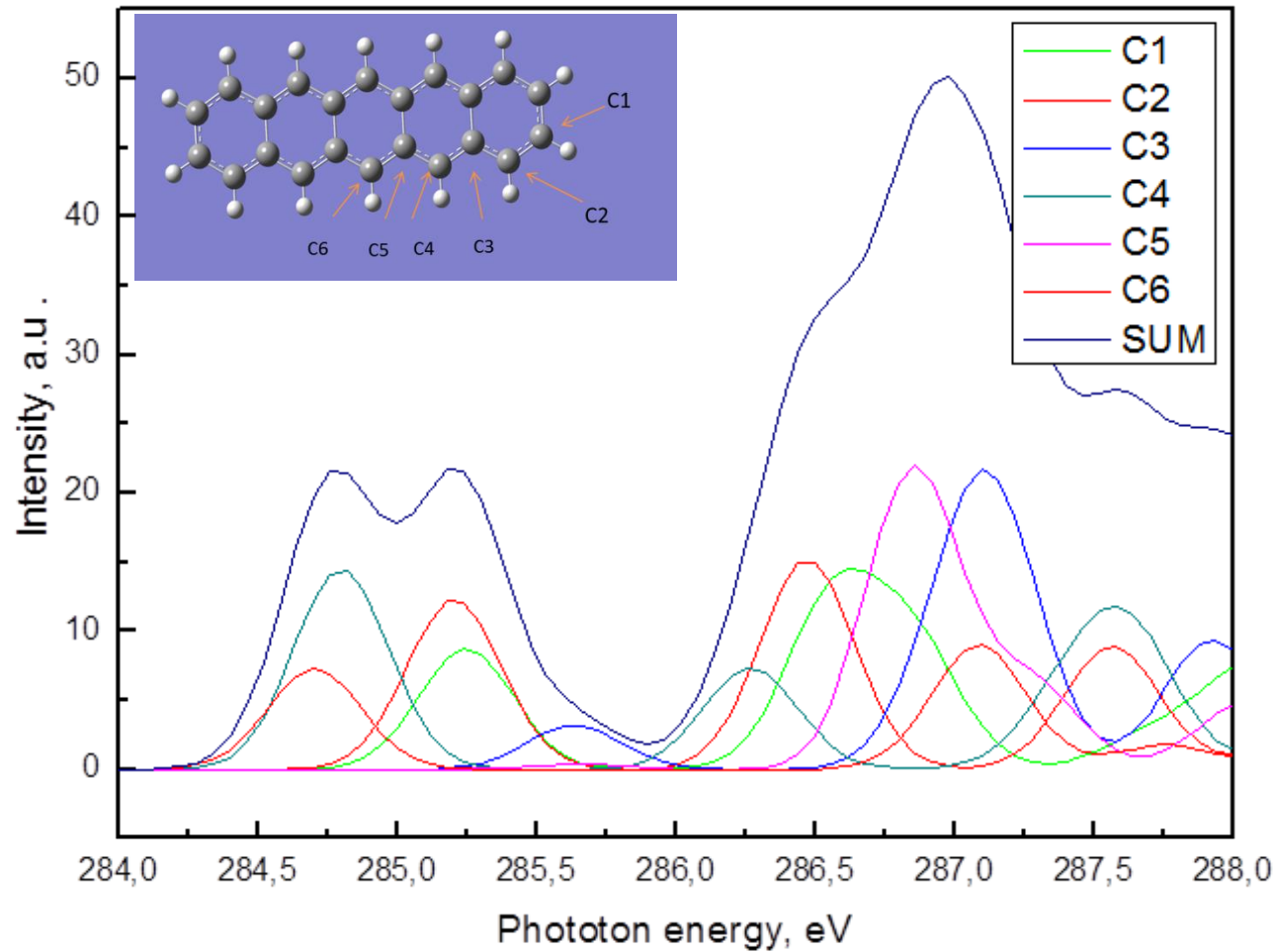
„Weak“

Angle dependence

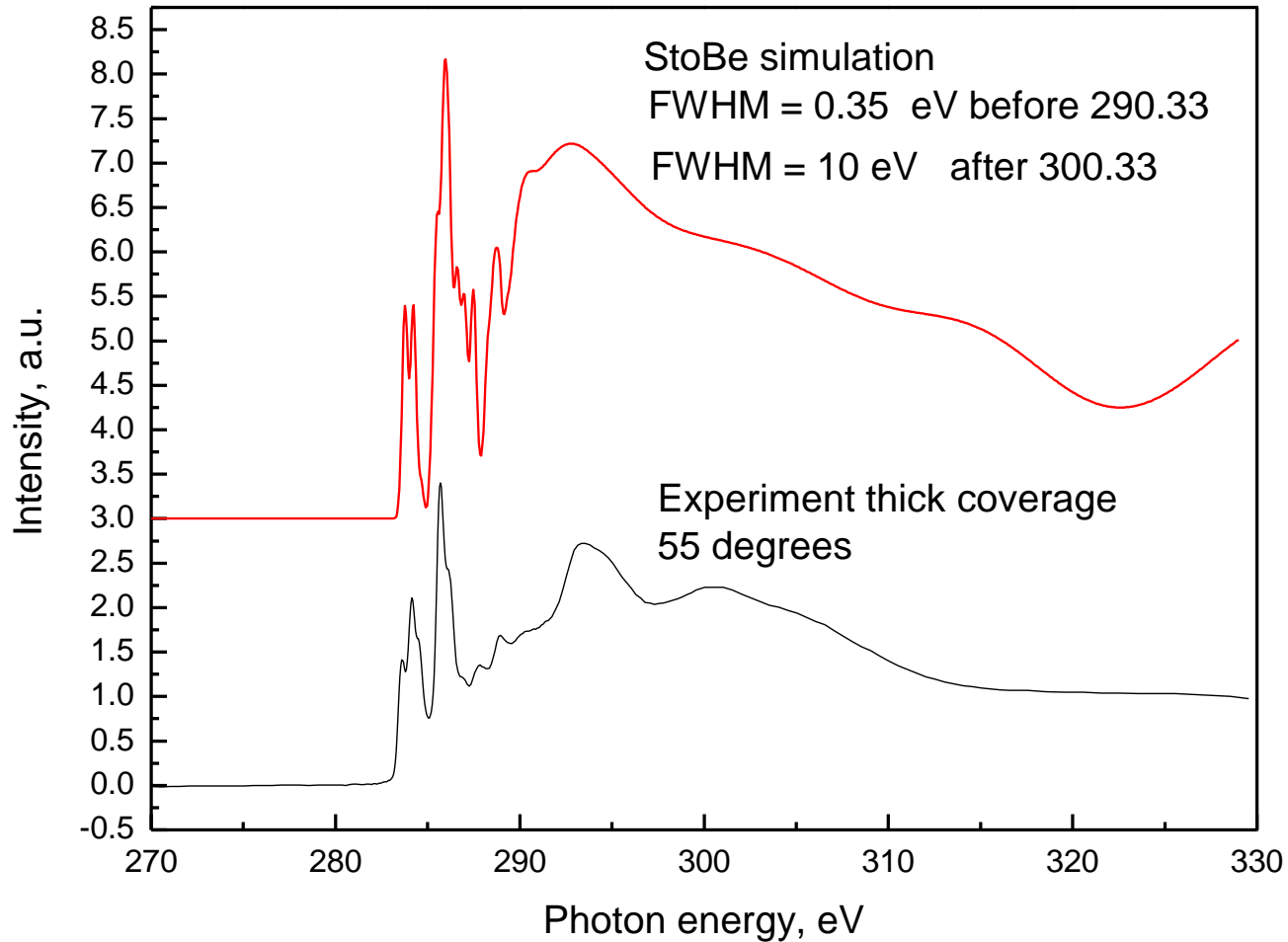


$$I(\alpha, \theta) = A \{ P(1/3) [1 + (1/2)(3\cos^2\theta - 1)(3\cos^2\alpha - 1)] + (1 - P)(1/2)\sin^2\alpha \}$$

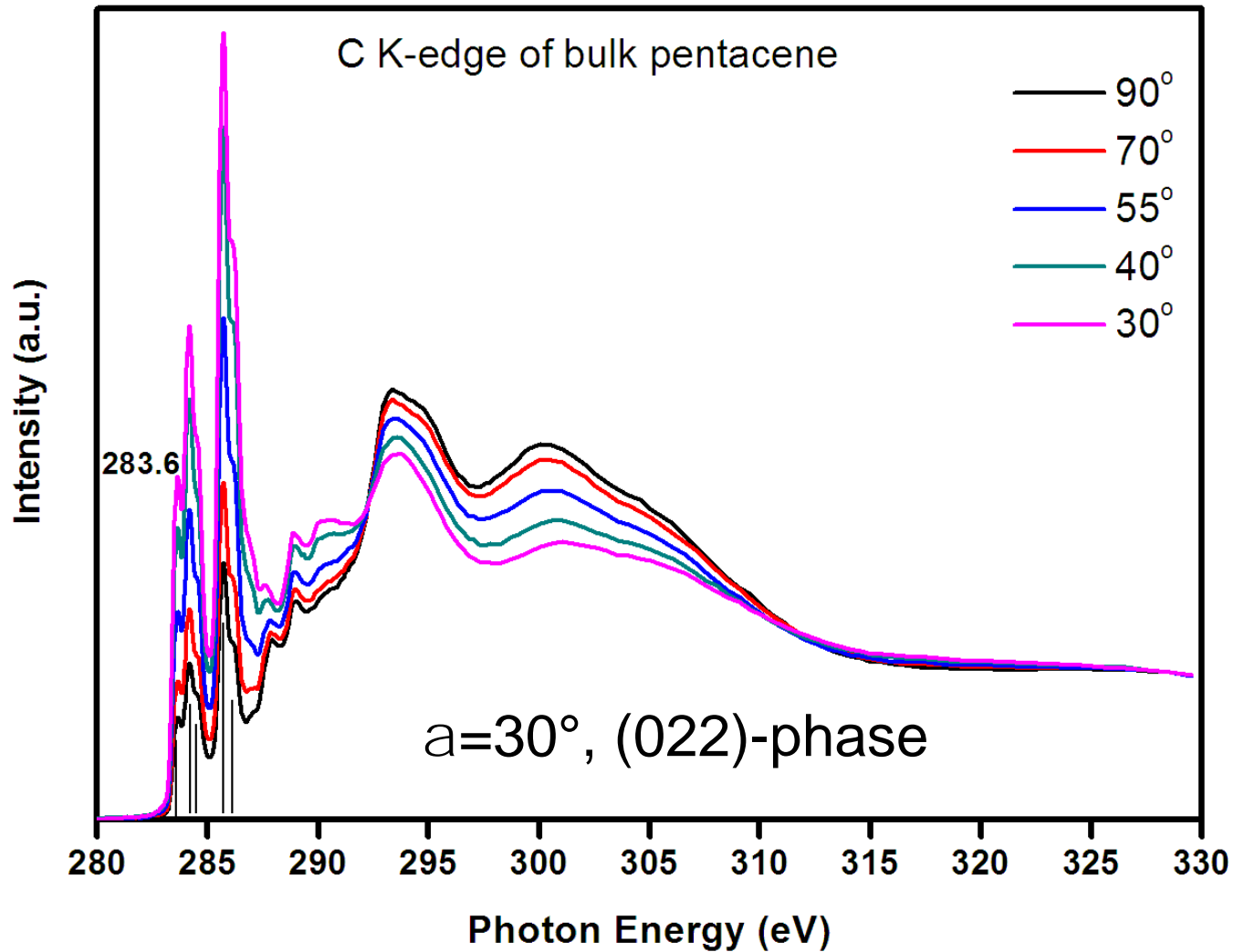
Simulation of NEXAFS spectra of Pn molecule (in gas phase)



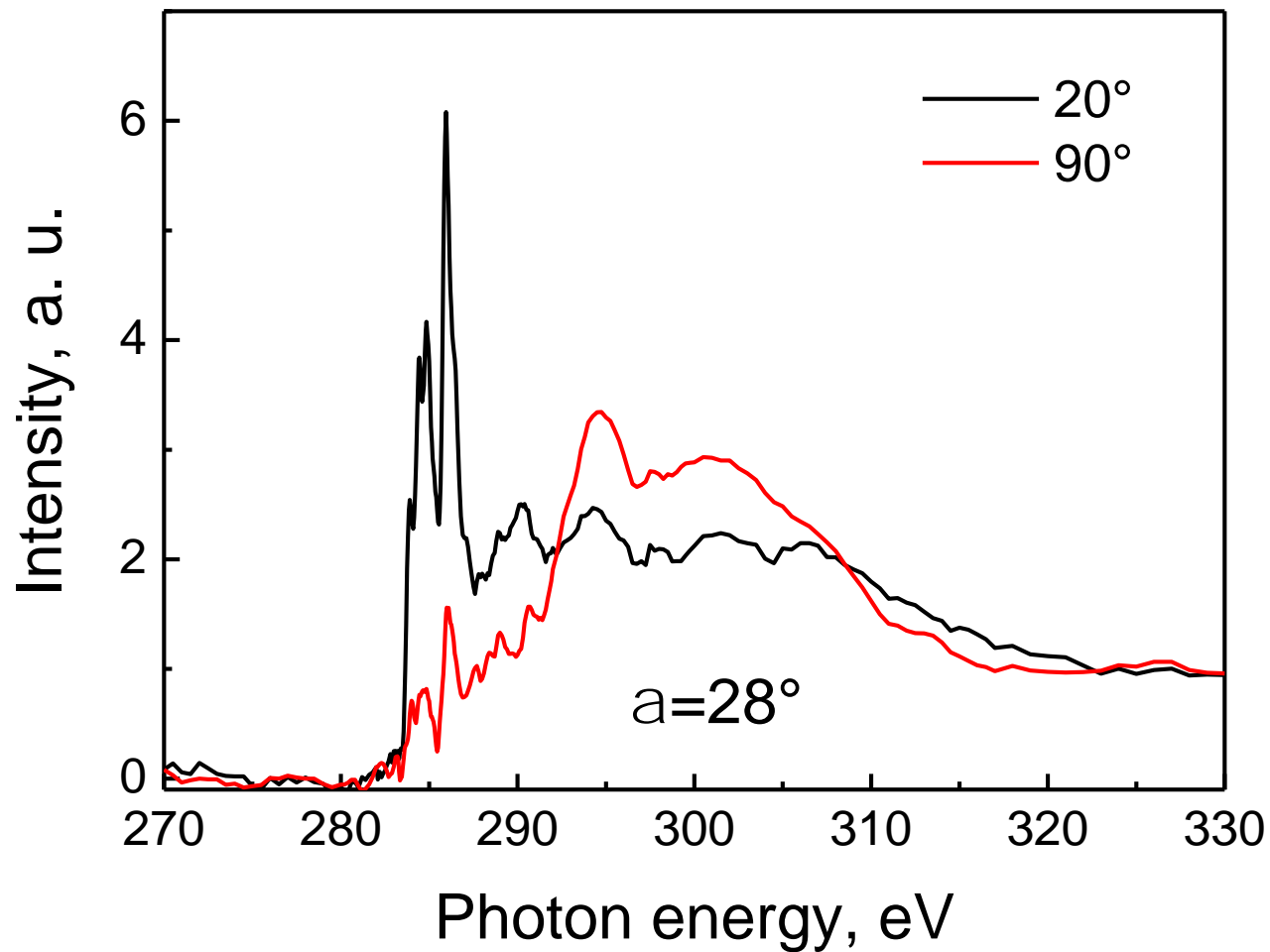
Comparison: simulation vs. experiment



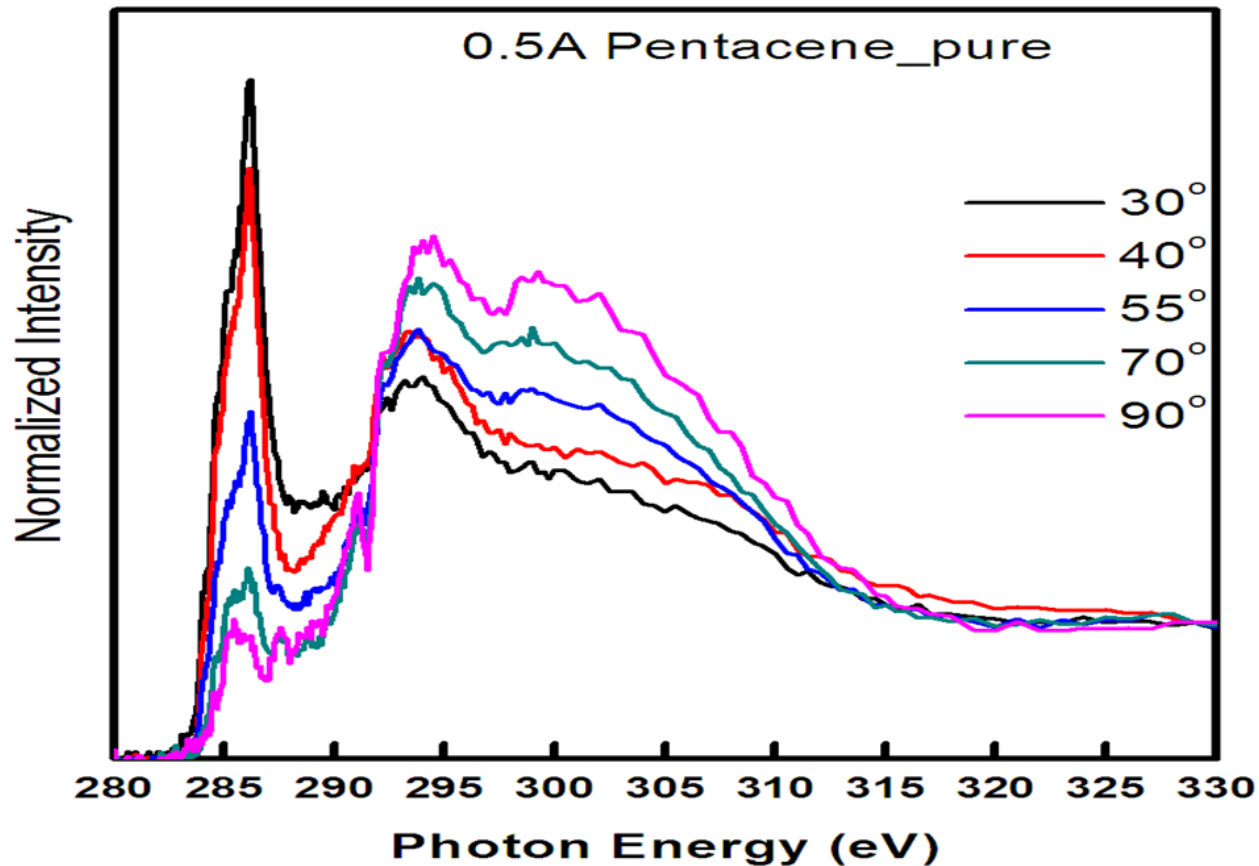
Pentacene on graphene: multilayer



Pentacene on h-BN: multilayer

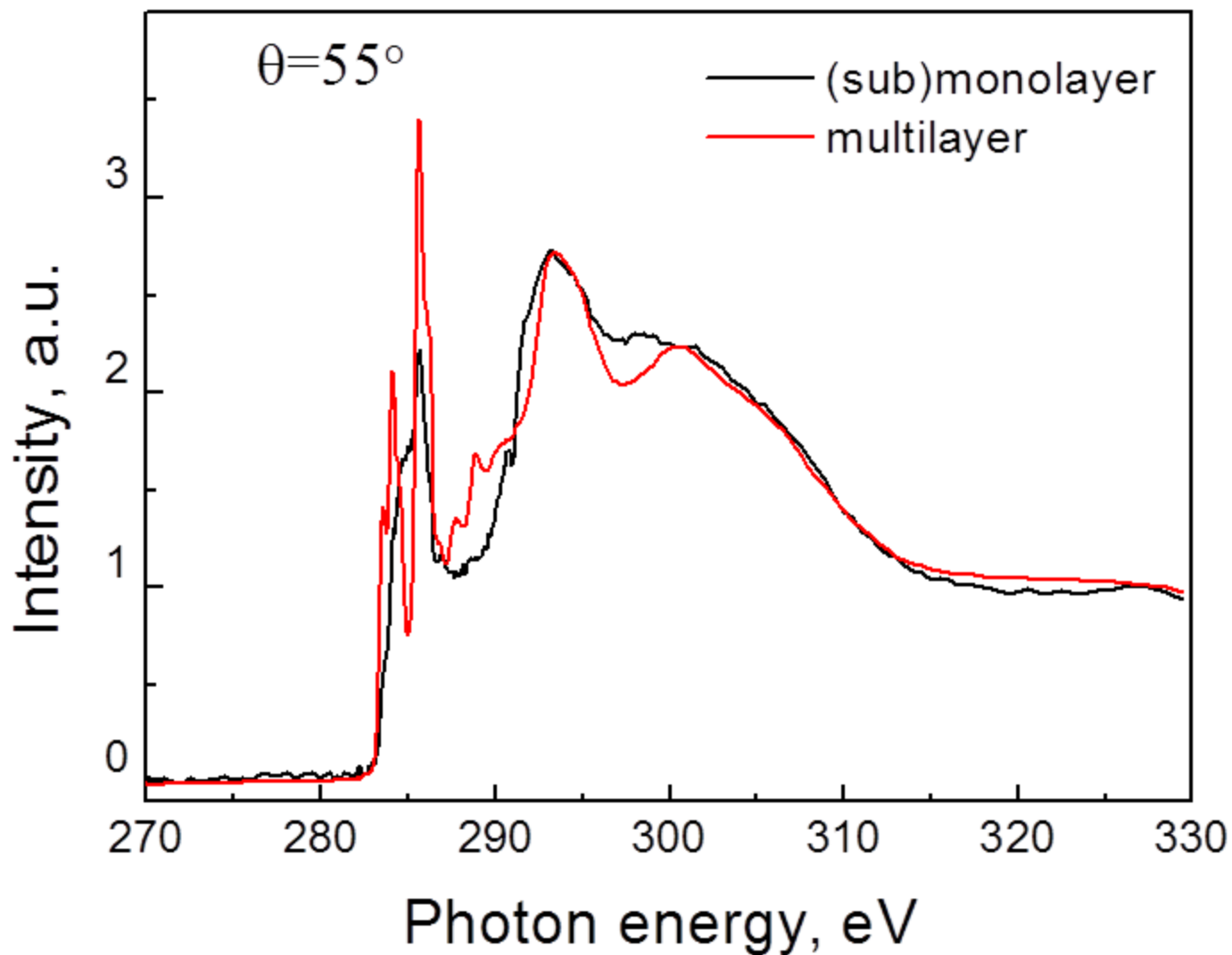


EG/Ni(111): Submonolayer

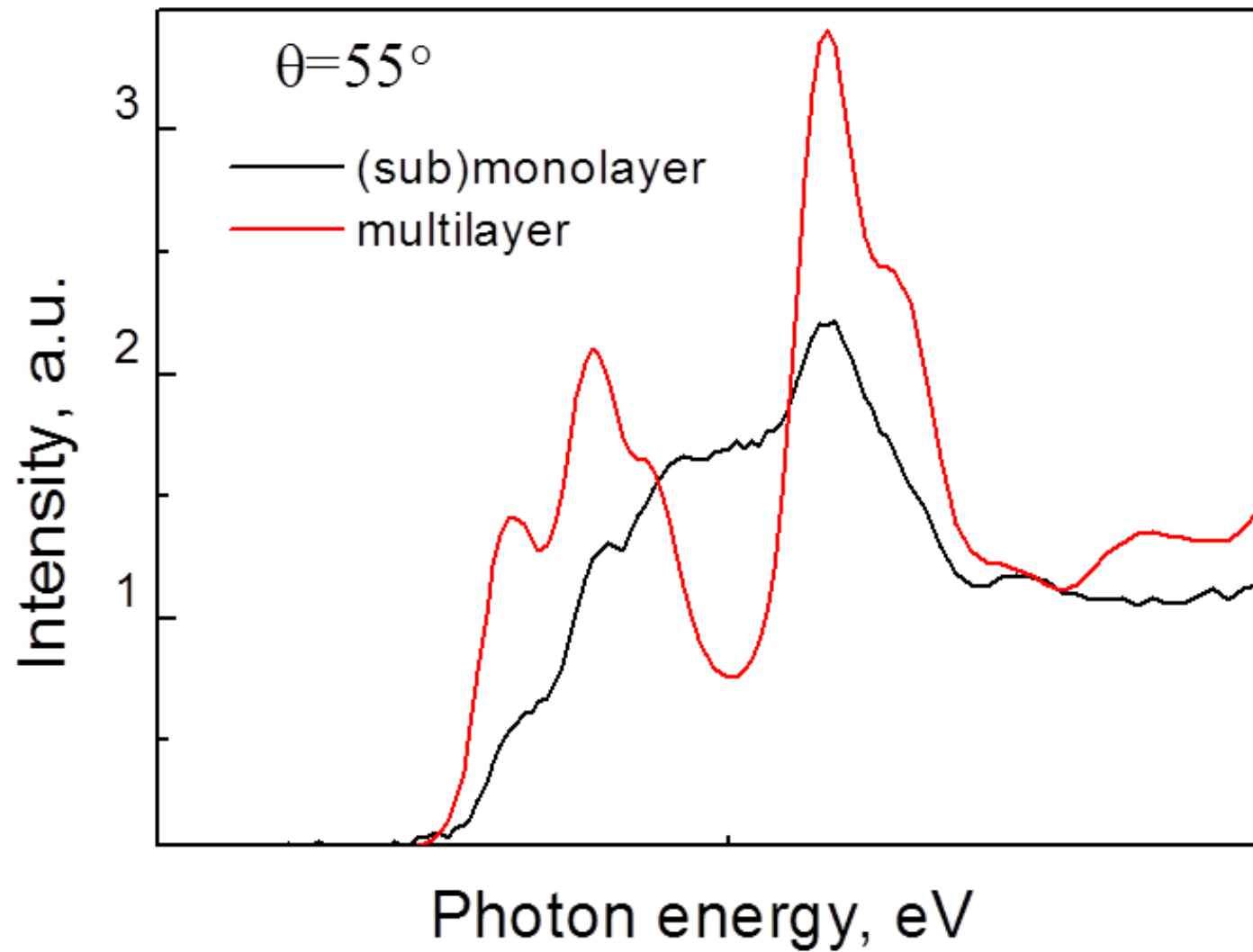


Broadening – hybridization – „strong“ interaction?
Or some additional contribution?

Pentacene/Graphene/Ni(111)

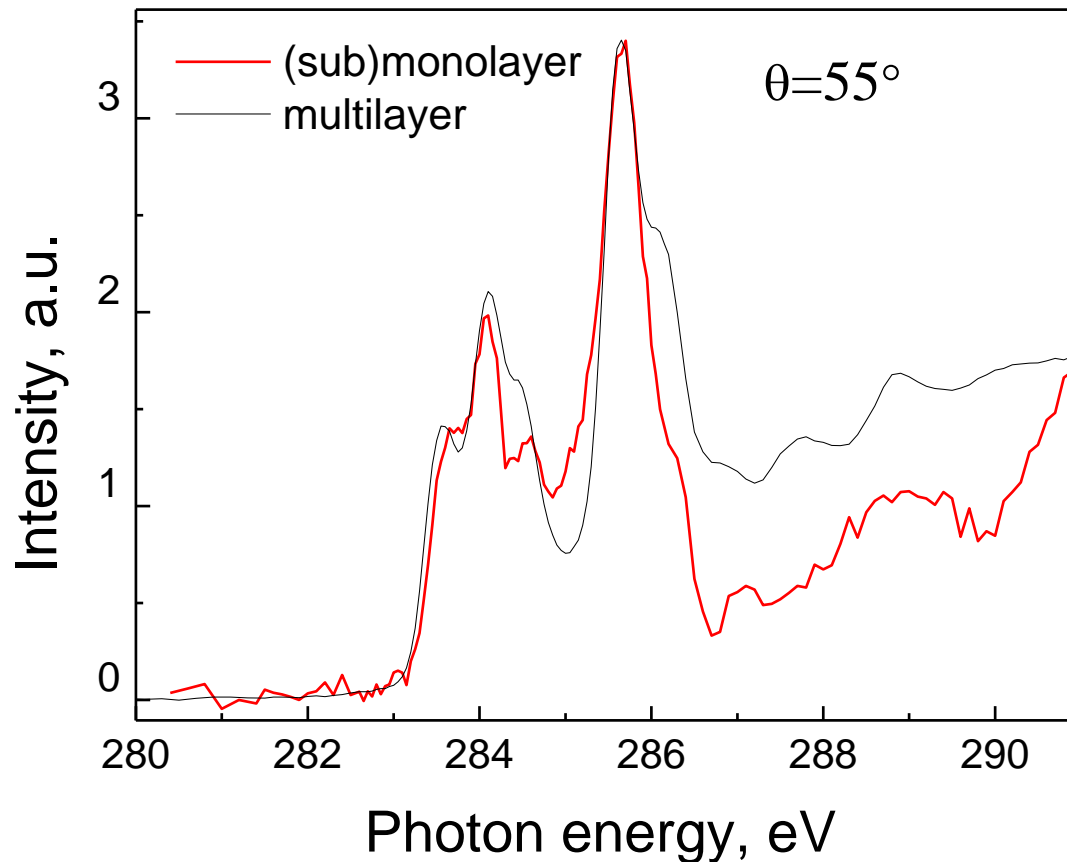


Pentacene/Graphene/Ni(111)



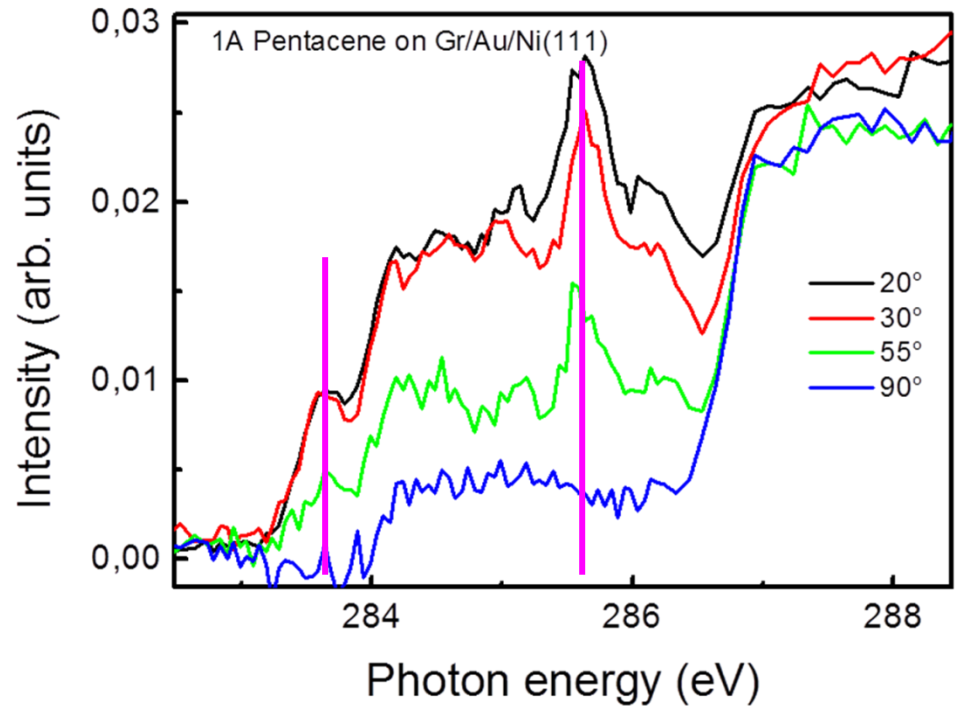
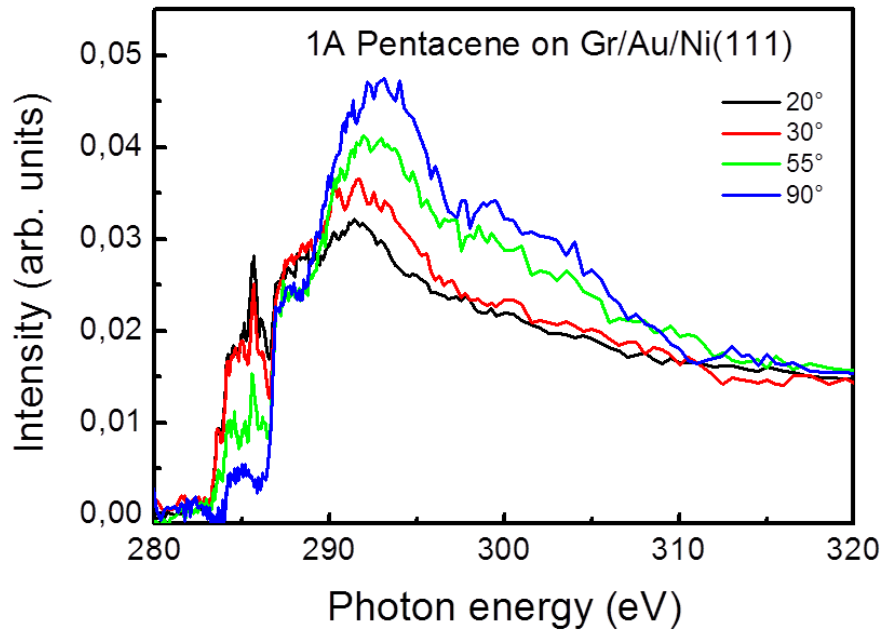
Correction of Graphene contribution

Pentacene/Graphene/Ni(111)

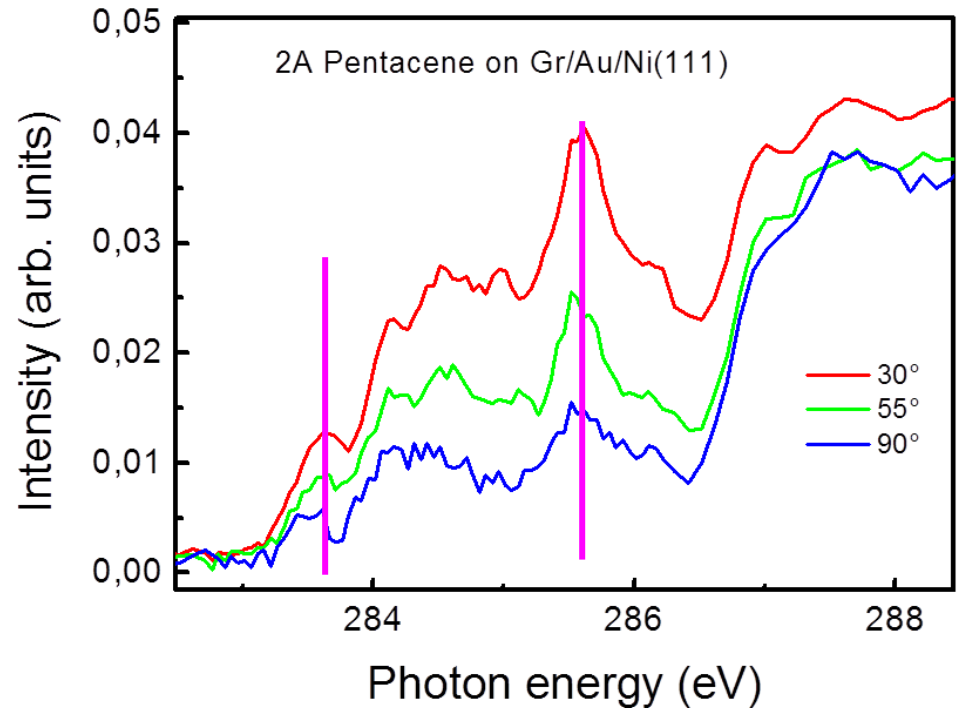
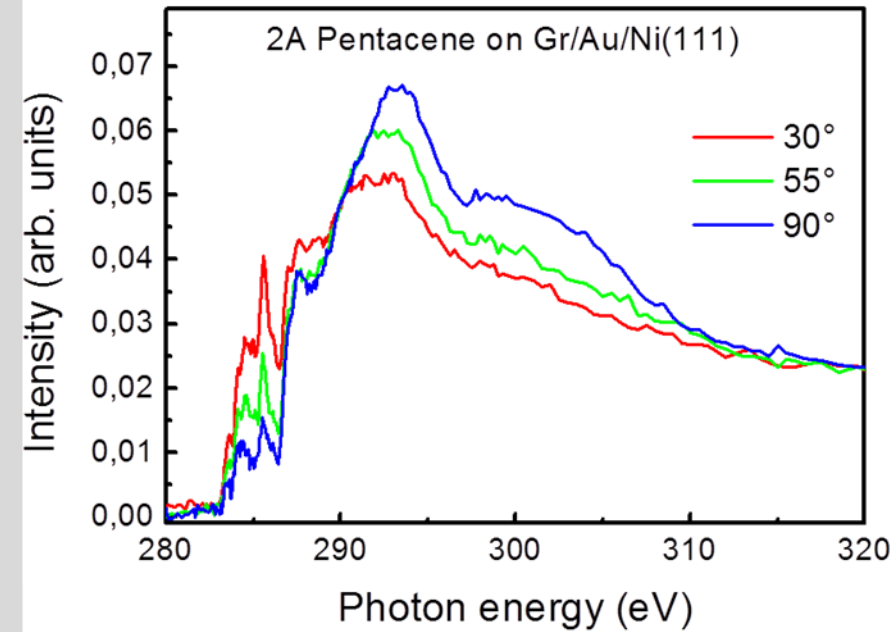


**No hybridization – „weak“ interaction!
Flat orientation of the first Pn layer!**

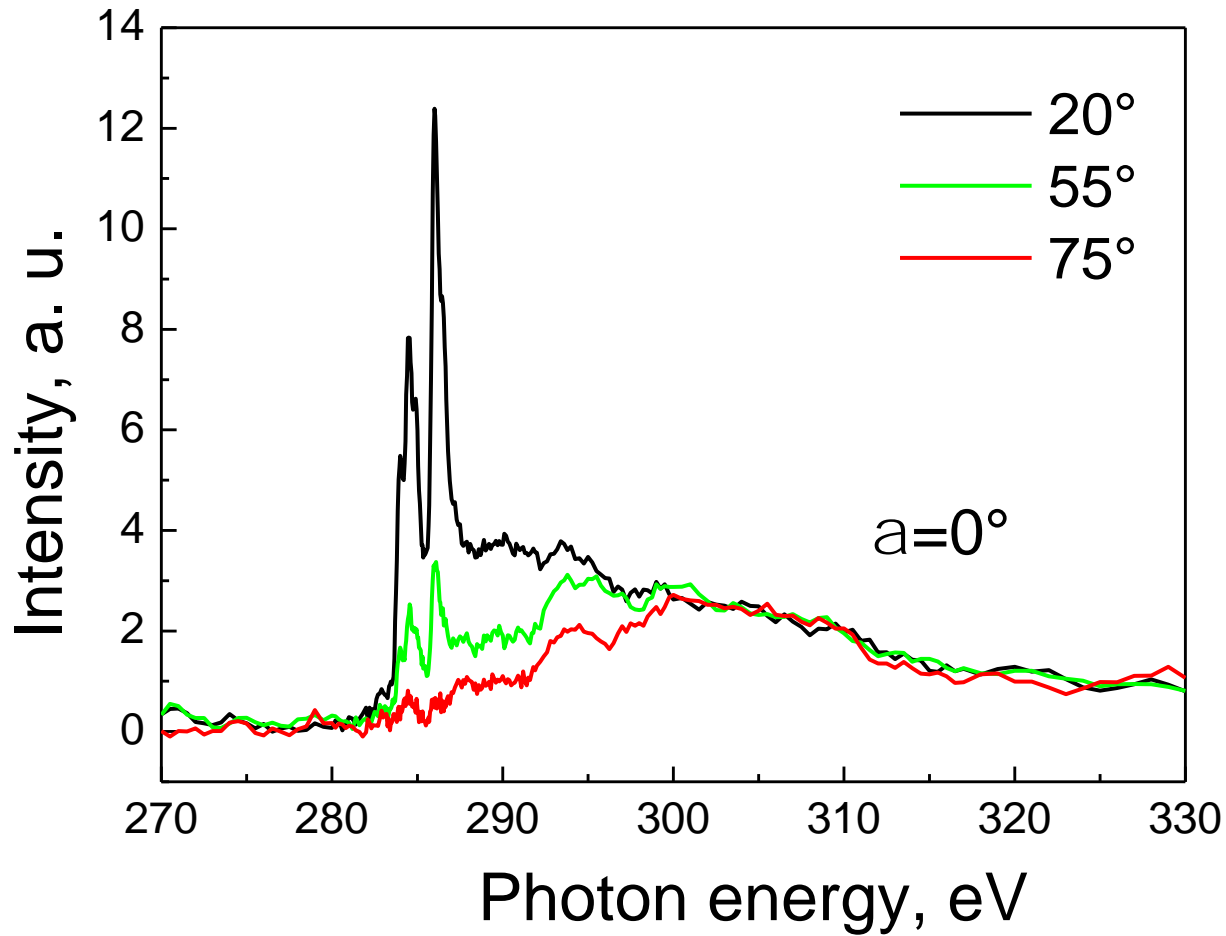
EG/Au/Ni(111): Submonolayer



EG/Au/Ni(111): growth of the second layer



Pentacene on h-BN: (sub)monolayer



Conclusions

1. Flat orientation of pentacene at submonolayer coverages – independent on substrate configuration
2. Direct growth of tilted phase already for the second layer
3. Weak interaction between pentacene and graphene
4. No „surface phase“ was observed – no interaction with metal substrate through EG layer

Thank you for attention!