

where G is the geometrical factor of the experimental arrangement. The measured displacement currents as well as the calculated dipole moment projections are presented in Fig. 5.

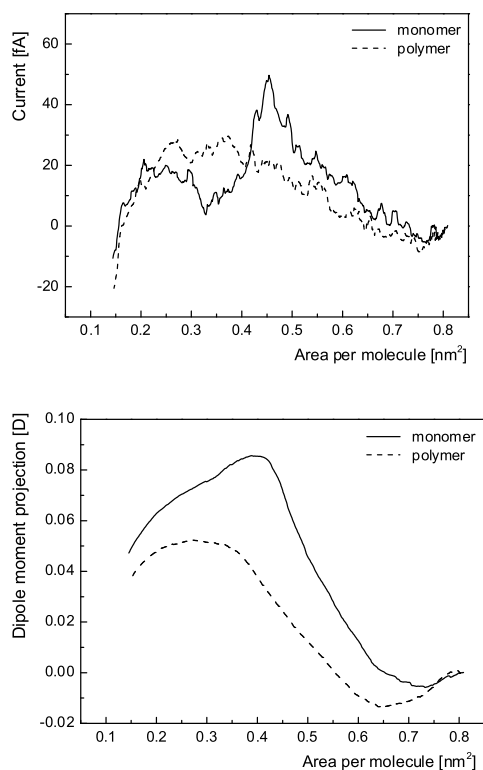


Fig. 5: (up) MDC signals obtained on monomeric DA and polymeric DA monolayers. (down) Calculations of the dipole moment projections of DA molecules before and after photopolymerization.

Because the dipole moment projection μ_z is a product of the dipole moment orientation and its magnitude, MDC technique can provide different profits. The dipole moment projection – area isotherm for monomers characterizes the orientational changes of the molecules, i.e. we assume a constant value of the dipole moment. However, after photopolymerization of diacetylene monolayer the molecular tilt is conserved and the MDC signal is generated by the change of the dipole moment magnitude. Therefore, the dipole moment projection of polymerized DA reflects blue to red phase transition.

The signals for as measured first three compressions in series after UV polymerization are shown in Fig. 6. The amplitude of the signal was changed, however the total induced charge (the area under the current-time, or current-area isotherm for constant compression rate) is conserved. Stabilization of the signal, formation of the monolayer, is therefore caused by the homogenization of material distribution, not by a destructive process. This result is in accordance with spontaneous domain creation in PDA [7].

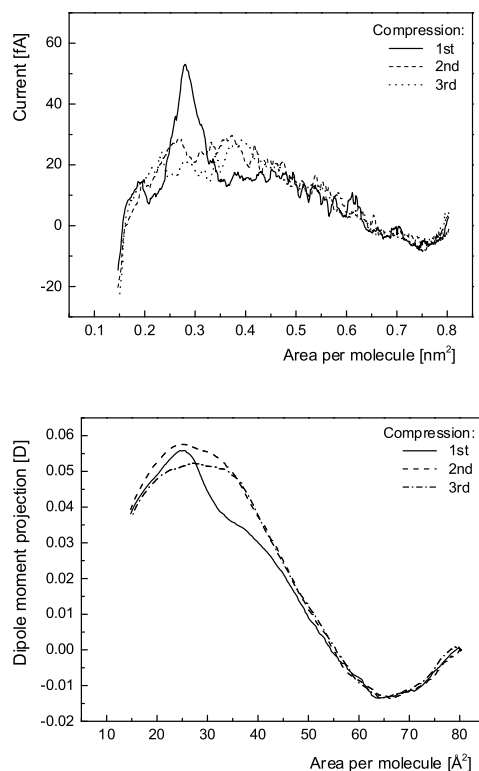


Fig 6: (up) MDC signals obtained on polymerized DA monolayer in course of first three compressions. (down) Calculations of the dipole moment projections of polymerized DA monolayer.

4. CONCLUSION

The MDC method was used for studying monolayer polymerization for the first time. It was shown, that its application is highly effective and significantly complement optical measurements (absorption spectroscopy). The experiment performed on the DA monomolecular film situated on the water surface revealed the effect of polymerization on the π -A as well as I – A isotherms and, thus, the changes of the molecular dipole moment could be calculated in the course of polymerization. Moreover, the experiment is sensitive to domain creation and their spatial distribution.

Further systematic measurements of the polymerization process in diacetylene monolayers are in progress.

Acknowledgement

The work was supported by the Slovak grant agency VEGA, project No. 1/3038/06 and by Agency for Promotion of Research and Development, project No. APVT-51-013907.

REFERENCES

- [1] D. Bloor, R. R. Chance, *Polydiacetylenes, Synthesis, Structure and Electronic Properties*, Martinus Nijhoff, Dordrecht/Boston/Landcaster (1985).
- [2] K. Morigaki, T. Baumgart, A. Offenhäusser, W. Knoll, *Angew. Chem. Int. Ed.* 40, 1 (2001), 172-174.
- [3] D. Charych, Q. Cheng, A. Reichert, G. Kuziemko, M. Stroh, J. O. Nagy, W. Spevak, R. C. Stevens, *Chemistry & Biology* 3 (1996), 113-120.
- [4] R. W. Carpick, D. Y. Sasaki, M. S. Marcus, M. A. Eriksson, A. R. Burns, *J. Phys.: Condens. Matter* 16 (2004), R679-R697.
- [5] Y. Tomioka, N. Tanaka, S. Imazeki, *J. Chem. Phys.* 91 (9) (1989), 5694-5700.
- [6] H. Tamura, N. Mino, K. Ogawa, *Thin Solid Films* 179 (1989), 33-39.
- [7] B. Tieke, K. Weiss, *J. Colloid Interface Sci.* 101 (1984), 129-148.
- [8] D. Barančok, J. Cirák, P. Tomčík, *J. Electr. Eng.* 45 (1994) 41.
- [9] D. Barančok, J. Cirák, P. Tomčík, I. Červeň, O. Foltin, *J. Electr. Eng.* 47 (1996) 209.
- [10] D. Barančok, J. Cirák, P. Tomčík, J. Vajda, *Phys. Stat. Solidi*, 169 (2) (1998), 267-273.
- [11] J. Vajda, M. Weis, D. Barančok, J. Cirák, P. Tomčík, *App. Surf. Sci.*, 229 (2004), 183-189.