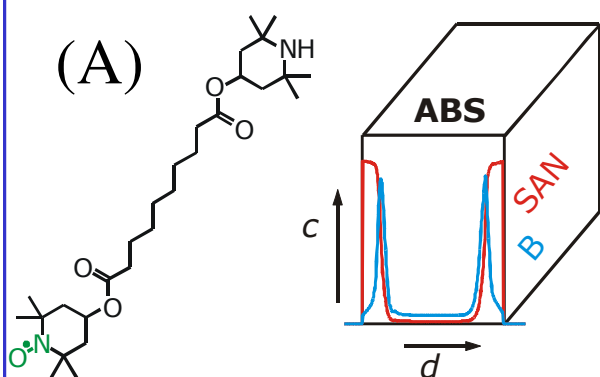


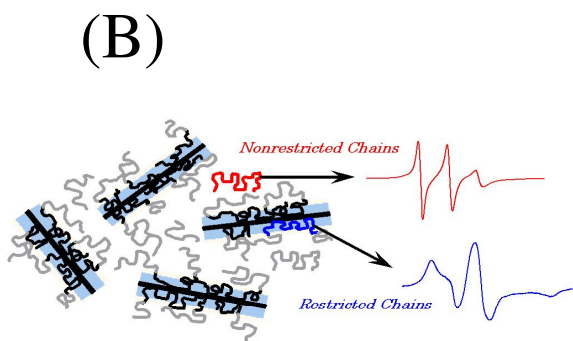
Morphological and Spatial Aspects in Polymer Degradation: From Heterophasic Polymers to Proton Exchange Membranes Used in Fuel Cells

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A unified picture of thermal **degradation** of poly(acrylonitrile-butadiene-styrene) containing a hindered amine stabilizer was deduced from pulsed ELDOR and ESR imaging (work initiated during PI's sabbatical in Germany).

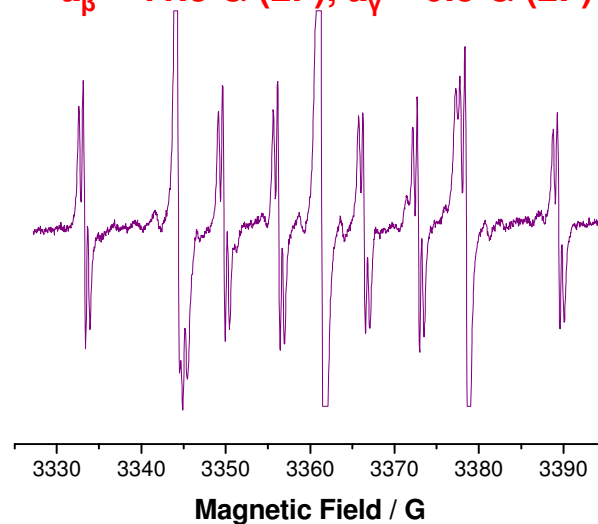
- (A) Jeschke, G.; Schlick, S., submitted June 2006 to *Phys. Chem. Chem. Phys.*
(B) Miwa, Y.; Drews, A. R.; Schlick, S. *Macromolecules* **2006**, 39, 3304-331.
(C) Danilczuk, M.; Schlick, S. *Polym. Mat. Sci. Eng. (Proc. ACS Div. PMSE)* **2006**, in press.



The direct effect of clay on polymer dynamics was detected in spin-labeled poly(methyl acrylate)/clay **nanocomposites** by ESR, XRD and DSC.

(C)
The MNP/CF₂CF₂R Spin Adduct

$$a_N = 16.6 \text{ G}$$
$$a_\beta = 11.5 \text{ G (2F)}, a_\gamma = 0.5 \text{ G (2F)}$$



Fluorinated radical fragments were detected and identified by **spin trapping** in model compounds for perfluorinated membranes exposed to reactive oxygen radicals.



Education and Outreach

- **The group**: undergraduate student L. Macomber, graduate students W. Aris and A. Bosnjakovic, postdoctorals Y. Miwa and M. Danilczuk, and visiting scientists A. Lund, M.V. Motyakin, K. Kruczala, and M. Pinteala.

- A collaboration with scientists from the **General Motors Fuel Cell Activity Center in Honeoye Falls, NY**, with focus on the degradation of polymeric membranes used in fuel cells, has been established. We meet every three months and discuss our results. Major advances include the development of spin trapping ESR methods that allow the detection and identification of reactive fragments upon exposure of the membranes and model compounds to oxygen radicals in the laboratory.
- The three-year proposal entitled **Assessing and Enhancing the Stability of Proton Exchange Membranes (PEMs) Used in Fuel Cells** was funded by the **Ford Motor Company** in 2005. We are studying the effect of membrane structure on its stability.
- The collaborations with GM and Ford are important because the stability of membranes used in fuel cells has emerged as a major problem in the transition to the hydrogen economy.
- PI Schlick has edited a book entitled “*Advanced ESR Methods in Polymer Research*”, with publication expected in September 2006 by Wiley Interscience.
- **Polymers in the Hydrogen Economy** is an important topic in Students’ presentations in the Physical Chemistry laboratory and Spectroscopy courses taught by the PI.