



**SIMULTANEOUS ELECTRICAL-RHEOLOGICAL MEASUREMENTS ON POLYMER COMPOSITES:  
BREAKDOWN AND RECOVERY OF CONDUCTIVE FILLER NETWORK UNDER SHEAR**

Z. Starý\*, J. Krüchel, H. Münstedt

*Institute of Polymer Materials, Friedrich-Alexander University Erlangen-Nuremberg, Martensstr. 7, 910 58 Erlangen, Germany*

*\*Corresponding author: [zdenek.starý@www.uni-erlangen.de](mailto:zdenek.starý@www.uni-erlangen.de)*

Most of the polymeric materials are insulators. In order to increase their conductivity the incorporation of the conductive filler at concentration higher than a percolation threshold is often used. In this case the particles of the filler form a conductive network in the polymer matrix. In this work the behavior of carbon black (CB) and carbon fibers (CF) networks in the polymethylmetacrylate under shear was investigated. Besides that the influence of the fillers on the rheological behavior of the composites was studied. The experiments were performed using a modified shear rheometer with plate-plate geometry enabling simultaneous measurements of rheological properties and conductivity of the composites melt. Special attention was paid to the systems containing the filler concentration corresponding to the percolation threshold. The shear stress was applied in two different modes – oscillation and creep. From the creep experiments performed it follows that by applying sufficiently high shear stress it is possible to destroy the particle network which leads to the decrease in conductivity of few orders of magnitude. The breakdown of the network proceeds quickly during first seconds of the creep and then rebuilding of the conductive network was observed. This secondary network is much more stable and can be destroyed only by applying the stress higher than in the first creep step. The influence of the applied stress, creep time and filler concentration on this behavior was studied in details. Furthermore, the influence of the electrical field on the building of the particle network was investigated. It was found that the applied voltage supports the movement of CB particles and thus accelerates the network formation in the melt.