Theoretical and experimental study of the dynamic percolation behaviour of carbon black filled polymethylmethacrylate prior and after shear-A novel three phase approach

J. Krückel, D.W. Schubert

PII: S0014-3057(14)00021-4
DOI: http://dx.doi.org/10.1016/j.eurpolymj.2014.01.011
Reference: EPJ 6337

To appear in: *European Polymer Journal*

Received Date: 25 November 2013
Accepted Date: 14 January 2014

Please cite this article as: Krückel, J., Schubert, D.W., Theoretical and experimental study of the dynamic percolation behaviour of carbon black filled polymethylmethacrylate prior and after shear-A novel three phase approach, *European Polymer Journal* (2014), doi: http://dx.doi.org/10.1016/j.eurpolymj.2014.01.011

Theoretical and experimental study of the dynamic percolation behaviour of carbon black filled polymethylmethacrylate prior and after shear-A novel three phase approach

J. Krückel, D.W. Schubert*

Institute of Polymer Materials, Friedrich-Alexander-University Erlangen-Nuremberg, Martensstr. 7, 91058 Erlangen, Germany

johannes.krueckel@ww.uni-erlangen.de

dirk.schubert@ww.uni-erlangen.de

Phone: +4991318527752

Abstract:

The time-dependent increase of the electrical conductivity (dynamic percolation) of carbon black filled polymethylmethacrylate under quiescent conditions was studied theoretically and experimentally. Therefore, a three phase model based on two different aggregate sizes is proposed leading to manageable fit functions, which are able to describe the experimental data. In order to test the model, the time-dependent electrical conductivity of the composites was monitored prior and after a short shear step. It was found that the shear step leads to a significant change in the conductivity and influences the aggregation kinetics of the system which is in agreement with our physical model proposed. Moreover, it could be shown, that the model has a much higher accuracy in describing the experimental data compared to the existing aggregation models where only one aggregate size is considered.

Keywords: Dynamic percolation, conductive composites, aggregation model, electrical conductivity