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Permittivity Increase of Carbon Black/Silicone Oil Suspension Induced by Electric Field

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A direct current (DC) electric field increases electrical conductivity of the carbon black/silicone oil (CB/SO) suspension by five orders of magnitude [1]. In our current study, the DC electric field induced permittivity change of the suspension was researched. The CB/SO suspension containing 0.2 wt% (concentration far below permittivity percolation threshold) of the CB filler was used for the experiments. It was found that application of the DC field to the suspension, simultaneously with the conductivity increase, results in the permittivity increase by up to three orders of magnitude in case of high field strengths (Fig.1). The permittivity increase of the suspension is due to the alignment of initially randomly positioned CB particle aggregates, which form a network of branched structure of micro-capacitor chains and densify upon increasing electric field strength and time.

The obtained results can be used in development of polymer/nanoparticle composites with anisotropic properties.

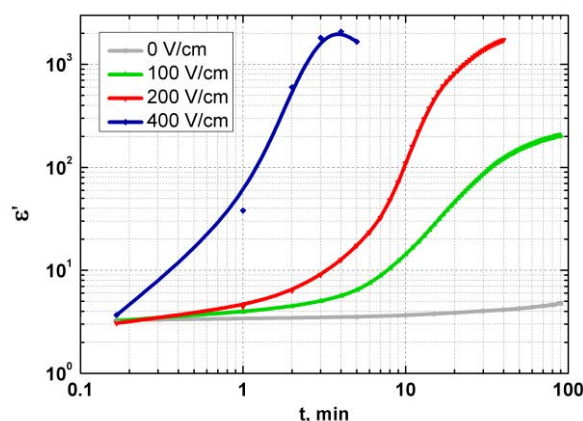


Fig.1 Relative permittivity (at 1 kHz) versus time for the CB/SO suspension containing 0.2 wt% of the CB depending on the DC field strength.

References

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Acknowledgements

This research was supported by the Latvian National Research Programme in Materials Science (IMIS2). Authors would also like to thank "IMCD Baltics UAB" for supplying "Wacker Chemie AG" silicone fluids.