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Cluster growth dynamics of nickel particles in viscoelastic matrices

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Elastomers can dynamically modify their mechanical properties in response to a magnetic field giving them the potential for new applications as soft actuators [1-2]. A common method of producing these materials involves embedding magnetic particles in an elastomer matrix. In the presence of an applied magnetic field, the particles tend to arrange themselves into chain-like clusters which react to external stimuli, even if the matrix is crosslinked [3].

As part of the research unit FOR 5599 on structured magnetic elastomers we investigate the formation process of these materials, paying particular attention to the interaction between particle cluster formation and simultaneous cross-linking of the surrounding matrix. We use particle tracking velocimetry techniques to observe the cluster development over time and investigate how this process depends on various parameters. Therefore, it can be concluded that the development of chains is influenced by not only the particle concentration and matrix viscosity, but also the rotation of the applied magnetic field. Its rotation can be used to adjust the mean length of the chains to a specific value.

Further investigation of larger sample sizes will be possible due to a new kind of Hallbach array that is currently under construction. This presentation will also cover the general idea of this machine.

References

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