Karlsruhe Institute of Technology

Seminar series of the Graduate School GRK 2078

Referee:	**Prof. Dr. Christina Papenfuß** Hochschule für Technik und Wirtschaft Berlin (HTW) / University of Applied Sciences
Date:	Tuesday, January 09, 2024
Time:	14:30-15:30h
Location:	Building 10.23, 3rd floor, seminar room 308.1 Please note that you can also participate in the event online
Title:	**Can liquid crystals inspire the modelling of fiber suspensions and fiber composites?**

Abstract

Liquid crystalline phases occur in certain chemical substances as a fourth state of matter between the solid and the liquid state. Liquid crystals show fluid-like flow behavior on one hand and anisotropic constitutive properties like solids on the other hand. The anisotropy is caused by an anisotropic orientation distribution of the elongated
(needle-shaped) particles. As a macroscopic measure of the anisotropy alignment tensors are introduced in analogy to the orientation tensors in the case of fiber suspensions. Equations of motion for the alignment tensors can be derived from a differential equation for the orientation distribution function. In addition to orientation diffusion and the influence of a velocity gradient, the orienting influence of the surrounding particles due to steric hindrance (mean field theory) has to be taken into account. This effect might have an influence in the case of concentrated fiber suspensions, too.
On a purely macroscopic level an equation of motion for the alignment tensor has been derived from the Second Law of Thermodynamics. A special case is the Landau theory of phase transitions, where the time derivative of the alignment tensor is proportional to a derivative of the free energy density. As the free energy depends on gradients of the alignment tensor in liquid crystals, the alignment tensor dynamics becomes gradient dependent.
Finally, a refined continuum theory on a mesoscopic level is sketched.
Balance equations for field quantities depending on position, time and orientation are formulated. Under some assumptions a differential equation for the orientation distribution function is derived.

You are cordially invited to take part in the event.

Prof. Dr.-Ing. Thomas Böhlke
(Spokesperson of GRK 2078)