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Why should a fluid mechanician know about graphene



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ABSTRACT:

Graphene is one of the most important materials of the 21st century, and its discovery (Nobel prize 2010) has led to a renaissance in many areas of physics and engineering. Graphene is now increasingly used in liquids as a colloidal dispersion, and this calls for an understanding of the fluid dynamics of this modern material. This talk will report on investigations by my group where molecular dynamics and continuum simulation techniques have been combined to address foundational questions regarding the rotational behavior and rheology of graphene: can the hydrodynamics of a particle whose thickness is only about 0.3nm be described by continuum theories? If so, can the framework established by Jeffery and others for anisotropic particles be used to predict the rotational behavior of graphene in shear flow? Should we treat graphene as a rigid or flexible object? Addressing these fundamental questions has led us to the prediction that dilute suspensions of graphene could exhibit a negative intrinsic viscosity, an exotic rheological behavior that does not have a counterpart in any other known colloidal system.

BIOGRAPHY:

Lorenzo Botto is Associate Professor in the Process & Energy Department of Delft University of Technology, the Netherlands. He leads a research group specializing in the application of mathematical and computational modelling, specifically to understand micro- and nanoscale transport phenomena involving particles and fluid interfaces. He obtained his PhD in Fluid Mechanics in 2009 from Johns Hopkins University (USA) under the supervision of Prof. A. Prosperetti. He did postdoctoral researcher under the supervision of Prof. K. Stebe at University of Pennsylvania (USA) and later with Prof. Y. Xu at Imperial College (UK). Before joining Delft University of Technology in 2019, he was Assistant Professor at Queen Mary University of London since 2012. His interest is on problems at the interface between fluid dynamics and materials science, most recently on the flow behaviour of carbon nanomaterials, a topic for which he was awarded a Starting Grant from the European Research Council. He has collaborated with industries including Glaxo-Smithkline Plc, HR Wallingford, Nanoforce Ltd, Shell Corporation, Beko Global, with the UK Ministry of Defence and participated in an advisory committee for the Dutch government on the fluid dynamics of COVID-19 transmission.