



Simple method for measuring intrinsic contact angle of a fiber with liquids

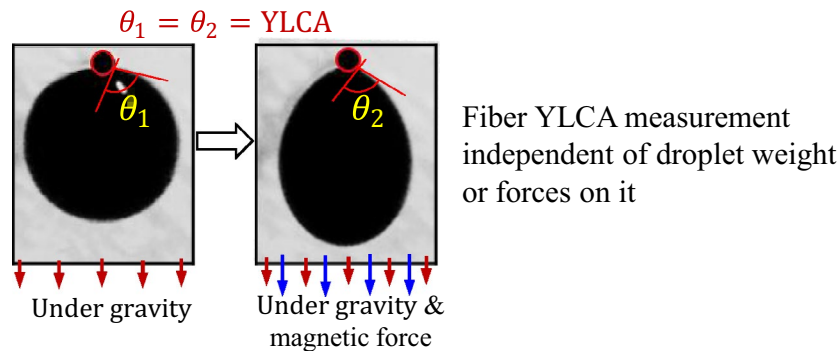
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Abstract

A simple method is developed to directly measure the intrinsic contact angle of a fiber (i.e., Young–Laplace contact angle of the fiber material) with any arbitrary liquid. It is shown that the intrinsic contact angle of a fiber can be obtained by simply measuring the angle between the tangent to the fiber surface and the tangent to the droplet at the contact line, if the droplet has a clamshell conformation and is viewed from the longitudinal direction. The novelty of the proposed method is that its predictions are not affected by the volume of the droplet used for the experiment, the wettability of the fiber, the surface tension of the liquid, or the magnitude of the body force acting on the droplet during the experiment. The accuracy of the proposed method is assessed through comparison with computational results obtained from validated numerical simulations or alternative experimental methods.

Graphical abstract



1 Introduction

Wettability is a measure of a surface tendency to remain in contact with a liquid, and it is often characterized using the Young–Laplace contact angle (YLCA), obtained by placing a small droplet on the surface and measuring the angle between the tangent to the droplet at the solid–liquid–air

contact line (CL) and the surface (Tavana and Neumann 2007; Quere 2008; Bormashenko 2017). The two main methods commonly used for YLCA measurement (also referred to as the intrinsic contact angle of the surface) are the sessile-drop method and the Wilhelmy force method. For the sessile-droplet method, a small liquid droplet is placed on the substrate and the YLCA is either measured, between the base of the droplet and the tangent to the droplet surface at the CL, or calculated, from the sessile-drop profile (Drelich 2013; Kalantarian et al. 2009; Bracco and Holst 2013). For the Wilhelmy method, the force needed to pull a partially submerged vertical flat plate out of the liquid is measured and used to estimate the YLCA of the plate.

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