

1. Introduction

Friction is an important property of textile materials that affects their desirable processing and performance. Friction is important in cases such as needle punching process, carding and spinning of yarns, wool felting, abrasion, and wear of cloth (P. Soltani & M. S. Johari, [Citation2012](#)). Despite conduction of vast amount of researches on various aspects of frictional behavior of textiles, the subject still is one of the most complicated, partly understood, and difficult to control phenomenon associated with textiles. Friction phenomenon arises from interaction between two in-contact surfaces. Factors affecting this interaction system either individually or collectively are bound to influence the frictional behavior of the two surfaces. Numerous investigations with the aim of measuring or understanding this phenomenon have been conducted. These investigations have led to classification of the relevant factors into material-related and process-related categorizes. While the former includes fiber morphology factors such as surface features, cross-sectional shape, dimensions, surface lubricant, and molecular orientation, the latter includes normal force between the two surfaces, contact area, sliding speed, and the environmental conditions (Marcicano, Tu, & Rylander, [Citation2004](#); Rajanala, [Citation2007](#); Wang et al., [Citation2016](#)).

Measurement of polymers friction coefficient is rather difficult due to mobility of polymer chains as the result of the contact stress, speed, temperature and lack of validated experimental method. Gustafsson ([Citation2013](#)) experimentally evaluated the static and dynamic friction coefficients of polyoxymethylene and polyamides, using interaction system between a steel sphere and polymeric surface. Rusu, Daniela, Benchea, Carlescu, and Olaru ([Citation2016](#)) and Rusu, Ionita, Cârlescu, Prisacaru, and Olaru ([Citation2015](#)) experimentally determined the frictional resistance and friction coefficient between a steel cylinder and polyurethane surface. Cho, Bhushan, and Dyess ([Citation2016](#)) explored the effects of speed, pressure and dwell time on the static and dynamic friction of polypropylene, polyester, and high-density polyethylene pair surfaces. While the effect of speed and pressure was elucidated in terms of changes in roughness and wear of

surface, the effect of dwell time was explained in terms of macro/nano-creep.

Generally, the classical laws of friction are not applicable to textile materials in the sense that is used for metallic materials. For this reason, various modified theories suitable to friction in textile materials have been developed (Briscoe, [Citation1996](#); Briscoe & Kremnitzer, [Citation1979](#); Briscoe & Tabor, [Citation1978](#); Cornelissen, de Rooij, Rietman, & Akkerman, [Citation2014](#); Gao, Wang, & Hao, [Citation2015](#); Rajanala, [Citation2007](#); Ramkumar, [Citation1998](#)). According to Ramkumar ([Citation1998](#)) the major factor which affects the frictional force between two polymeric surfaces is the area of contact. This depends on the surface geometry, roughness, contact time, and the exerted load on the contact area. In addition to the contact area, sliding of two surfaces relative to each other also depends on plowing or shearing of in-contact surfaces.