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Topic of the Speech:
Applications and Measurements Methods of Radiant Heat Exchange of the Human Body - Opportunities and Limitations of Newly Engineered Fibers, Fabric and Finishes

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Professor Emiel DenHartog has a Masters' degree in Experimental Physics from the University of Utrecht in the Netherlands and PhD in Medical Physics from the Erasmus University, Rotterdam, The Netherlands. After his PhD he went to work for more than 15 years in the Defense research on evaluation and innovation of military protective clothing systems where he studied modeling human heat exchange in extreme environments. Over time he moved towards the impact of protective clothing on the human body.

Since 2013 he is Co-Director of the Textile Protection And Comfort Center (TPACC) and Associate Professor in the Textile Engineering, Chemistry and Science department in the Wilson College of Textiles at NC State University. In his research he focuses on the interaction between clothing and the human body to optimize protection, performance and comfort. Recently his worked has focused more on the local interaction of fabrics and materials with the skin and the effects of the local microclimate on skin health. Main focus of research is on using and developing test and evaluation methods for functional textiles to demonstrate and quantify protection, performance and comfort of clothing and related textile products that interact with the body. With this he actively collaborates with a wide range of scientists providing measurement and evaluation support on anything related to improvements on human health, performance and comfort.

He teaches classes on Clothing Physiology and Textile Testing and publishes on comfort and protection evaluations of textiles and clothing. Since 2015 he has been member of the National Academy of Sciences Institute Of Medicine (IOM) standing Committee on Personal Protective Equipment for Workplace Safety and Health (COPPE).

ABSTRACT SUBMISSION

-For invited speaker only

Applications and Measurements Methods of Radiant Heat Exchange of the Human Body - Opportunities and limitations of Newly Engineered Fibers, Fabric and Finishes

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ABSTRACT (NO MORE THAN 500 WORDS:)

Following the fundamentals of heat transfer human body heat loss through clothing is through conduction, convection, radiation and evaporation. Of these 4 the radiative heat loss has been the least studied. Depending on environment and clothing radiative heat loss is a significant but usually not dominant factor in heat loss. Notable exceptions are in the presence of hot surfaces or objects or in the full sun. Recently, novel fiber and finishing technologies are aimed at influencing the radiant heat exchange between body, clothing and environment. Ceramic fibers and ceramic particles added to fibers are aimed at increasing emission of radiant hat from the fabrics and increasing absorption of radiant heat from the body. Recent literature and measurements have demonstrated that some of these materials indeed increase fabric emissivity. Unfortunately, in some cases the applications of technologies are based on misconceptions of radiant heat exchange. Enhanced radiant heat absorption will either enhance or reduce radiant heat loss from the body depending on environmental conditions and existing temperature gradients.

In this lecture I will go through the basic principles of radiant hat exchange, demonstrate the driving equations and their consequences and link this theory to fabric measurements. Furthermore, an overview of previous literature will be provided, demonstrating these principles at work in realistic test conditions. Then this body of knowledge will be used to study how radiant heat exchange may be affected by novel fibers or finishes, thus providing targeted benefits to the human body, but also provide caution to the effects that can be achieved realistically. This extensive overview should provide clear guidelines on how radiant absorptive and reflective technologies could be used in principle, and how these technologies should be evaluated to demonstrate their effectiveness.