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PhD Project title: Integrated innovation within textile materials

Period: September 2009 – August 2012

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Goal

The goal with the project is to investigate which principles, methods and competencies are necessary to create innovation within textile materials. The possibility for innovation takes its point of departure in the particular possibilities textile materials offer: they distinguish themselves as a material group compared to other material groups (such as stiff materials), by their tensile strength, shapeability and flexibility. Furthermore, textiles have acquired new functionalities during the latest years, by becoming "smart" or responsive, i.e. by in some way being able to react to stimuli from their environment. This contributes to increasing the special properties textile materials offer for innovation. With "integrated" innovation, is intended a kind of innovation that is linked to an understanding of the cross field between different actors within technology, production, design and market, as well as the users, and these actors' motivations in relation to new kinds of applications and functionalities for textile products.

The goal with the PhD project is therefore to describe and analyze this cross field, in order to answer the following questions:
1-How can potential future applications for textiles be revealed, using the materials' properties as well as the needs of future users as points of departure?
2-How should development processes be staged in order to create integrated innovation within textile materials?
3-Which competencies are necessary in order for the development of new applications and functionalities of textile materials to be brought forward?
The PhD project can be based on a selected material property, technology or use context, in order to narrow the focus.

Backgroud

But what are textiles, and why are their properties unique? Textiles are (normally) 2-dimensional materials, constructed from 1-dimensional materials (thread, fibers and filaments) held together by friction and physical locking, in woven, knitted or non-woven structures. Both the 1-dimensional and the 2-dimensional structures distinguish themselves by having tensile strength, but almost no stiffness or compressive strength. This is different from most other materials, and has a large influence on how the form giving of a product is made. If one thinks of traditional stiff materials, products often have a box like structure, e.g. mobile phones, computers, houses, etc. The properties of textile materials make it possible to think products differently, and the functionalities often become different. An example is packaging – a box compared to a bag, another example is the building envelope – houses compared to tents. Finally, one must remember one of the most distinguished properties of textiles: they are pliable and supple, and are therefore well suited for products that adapt themselves to their surroundings. These properties have been known for centuries, but the development within microelectronics, nano technology, as well as a generally speaking deeper insight in materials, has made it possible to integrate new advanced functionalities in textile materials. The border for what a textile is moves. This opens up for new

application possibilities and totally new products – but it requires insight in the new properties of the materials and in the new use patterns. A cross field is thus created, between on the one hand the new potential applications for textiles, how these are discovered, and an understanding of the different actors, and on the other hand an insight in the materials' properties, in the development possibilities offered by technology, as well as the realization of this development. There is a lot of technology, but to which new functionalities and applications for textiles, which have a value for the users, and take their point of departure in the materials' unique properties, can this be used?

Target group

The target group for the research includes both companies and educational institutions. In relation to companies, it includes both companies that develop traditional textile design and companies that develop technical textiles, and finally companies that develop products that can be part of textile products. In relation to educational institutions, the target group includes institutions providing education for design engineers, textile engineers, textile design, as well as other design and engineering educations.

Method

The chosen method gives a broad and varied approach to the subject, and is based on design research methods that have been used and developed within similar projects, with a special emphasis on the method "Action Research". The latter implies that the PhD student in dialogue with different actors explores textile innovation through practical development. This will take place through participation in textile development projects, among other through an external research stay, and through cooperation with Danish and foreign companies. This will constitute the basis for gathering the empirical data (observations, interviews, experiments). Furthermore, workshops will be held with students at DTU, The Danish Design School, Kolding School of Design as well as relevant educational institutions abroad.