

## *Deployable wet-responsive materials*

**When a wetting liquid spreads over and wicks into a fibrous material, it causes the material to deform. We study two deformation mechanisms: elasto-capillary and -wetting effects that lead to spontaneous internal stresses in the materials. In-plane elasto-wetting stresses are difficult to reveal: strong interfiber friction conceals the effect. Conversely, the elasto-capillary effect produced by menisci in pores can be identified through a specific stress distribution in the fibrous matrix. We develop a theory of flow-induced stresses in a fibrous materials and experiemnt with different fibrous structures such as nanofiber yarns and mats, woven and nonwoven fabrics, carbon nanotubes and nanoporous membranes.**

**In summary, this research aims to investigate new effects caused by interactions of liquid with fibrous materials. We develop a new class of fiber-based materials that can be deployed on demand using different stimuli.**

# Deployable wet-responsive materials



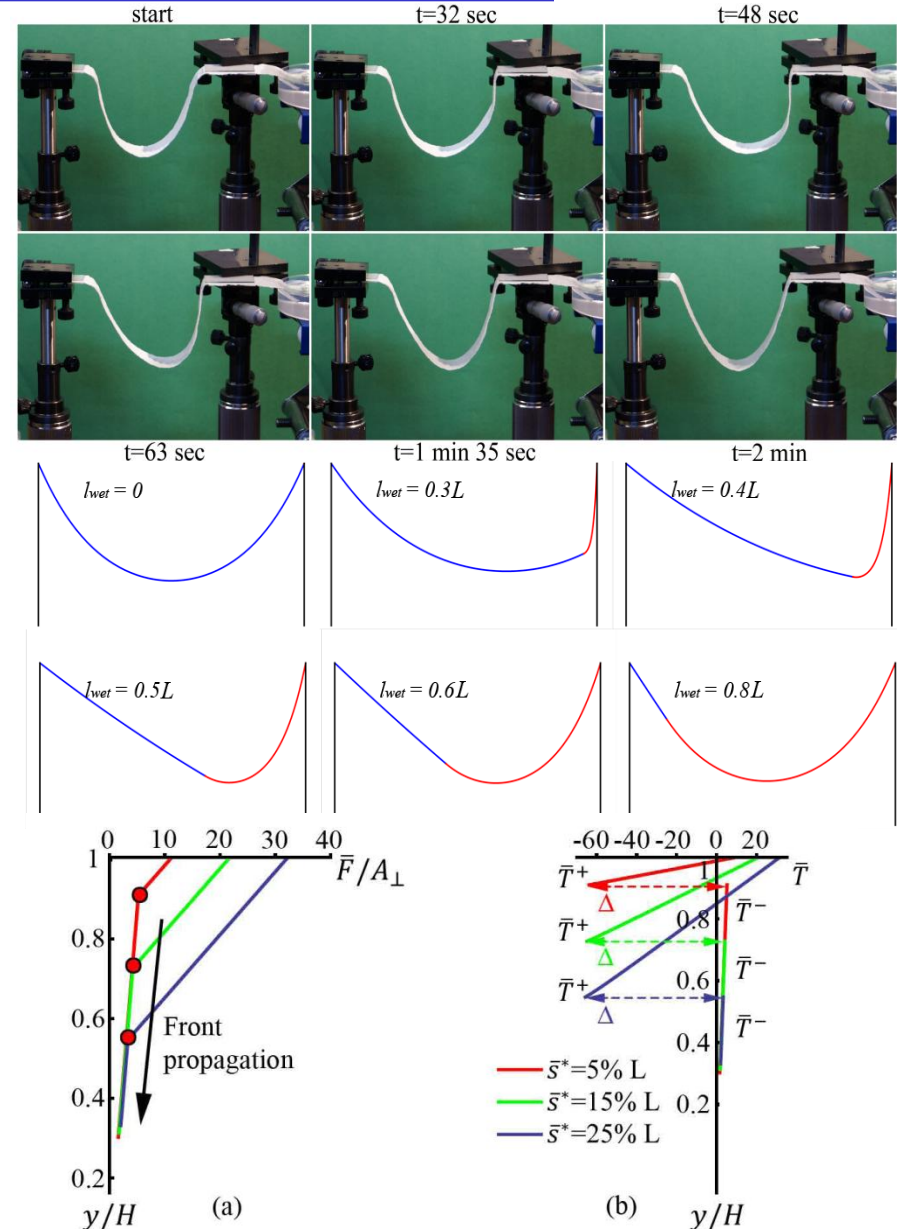
Kornev's lab

□ **Strategic goal:** development of new fiber-based materials which would deform upon contact with liquids in a controllable manner

**Current focus on:** fundamental studies of flow-induced deformations in fibrous materials

A flexible yarn/fabric hanging under its own weight between two posts assumes a shape of catenary. If one end of this yarn is immersed in the liquid, due to the action of capillary forces the liquid fills up pores and moves forward to the other end. Induced deformations are explained by the model

## Stress distribution in wet catenary



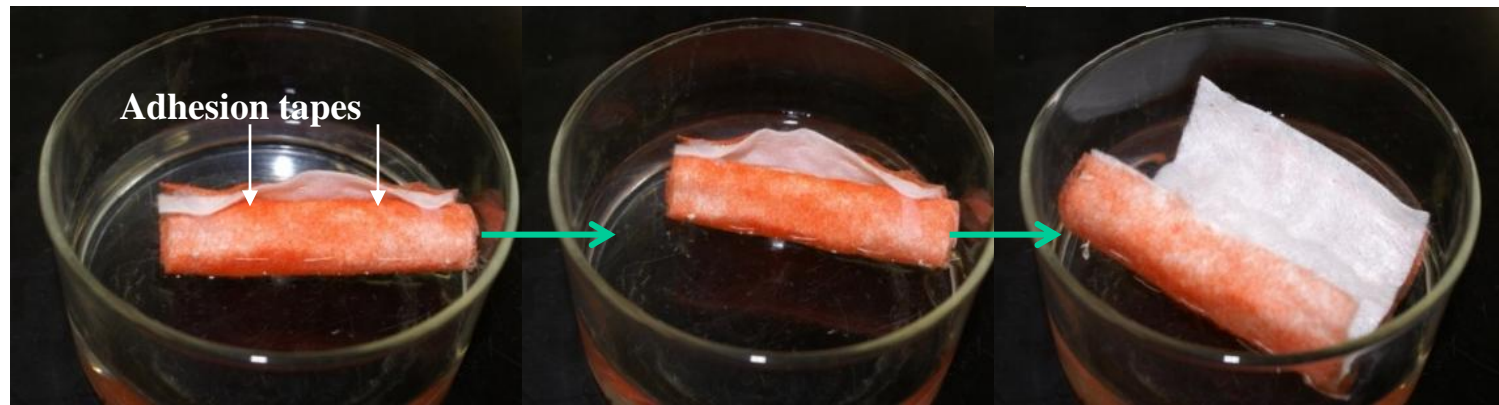
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fundamental  
studies of flow-  
induced  
deformations in  
fibrous materials

**Applications** The  
designed system  
after being air  
dropped into  
polluted water will  
deploy itself, absorb  
the contaminants  
and prevent further  
vaporization of  
noxious gases.

**Unfolding manner of *Gardenia August Beauty*: a bud before and just after opening**



**Electrospun scroll which opens up upon contact with water**

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