Project title: New machine concepts for biobased fibres

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Collaborators: RWTH Aachen University, German Machine Manufacturer

Proposal (250 words):

Introduction:
Textile machines have been optimized for their productivity for years. Similar to a racing car in Formula One, which can deliver its maximum performance only on a modern race track it is designed for, modern textile machines are also optimized for today's widely used commodity polymers. If these modern high-performance plants are used for processing of new polymers, for example, of biopolymers, new polymers often appear to be unsuitable for processing.

Hypothesis and Objectives:
New production processes are required for new polymers.
The amount of these polymers and so the possible turnover with machines is too low to start development.
The focus is on melt spinning and texturing of filament yarn.
The process – structure correlation is studied.
By analysing the fibres produced, relationships between process and material structure will be derived.
Proposals for machine concepts are developed.

Setting and Methods:
-Selection of suitable biobased polymers
-Analysis of the existing production technology for the production of filament yarns
-Analysis of the process - structure correlations of today's commodity polymers
-Analysis of the process - structure - correlations of the selected biobased polymers in laboratory scale
-Upscaling the processes from the lab scale to the industrial scale together with industry partners
-Economic analysis of the developed production processes
The work will be done in cooperation with at least one leading German mechanical engineering company.

Impact:
Demonstration of processability of biopolymers in industrial scale and at reasonable costs and quality. Overcoming today's widespread scepticism against biobased polymers as too difficult to process and too weak in performance.

Requirements candidate: Highly motivated student with good English communication skills and proactive and resolute attitude.

Keywords: Fibre, mechanical engineering, production technology, process-simulation, polymer, textile

Maastricht University

Top 5 selected publications:

Nr.	Title	Authors	Journal
1	Polyethylene-based carbon fibers by the use of sulphonation for stabilization	Wortberg, G.; De Palmenaer, A.; Beckers, M.; Seide, G.; Gries, T.	Fibers 3 (2015), S. 373-379, doi: 10.3390/fib3030373
2	Orientation of well-dispersed multiwalled carbon nanotubes in melt-spun polymer fibers and ist impact on the formation of semicrystalline polymer structure : a combined wide-angle X-ray scattering and electron tomography study	Vad, T.; Wulfhorst, J.; Pan, T.-T.; Steinmann, W.; Dabringhaus, S.; Beckers, M.; Seide, G.; Gries, T.; Sager, W.F.C.; Heidelmann, M.; Weirich, T.E.	Macromolecules 46 (2013), H. 14, S. 5604-5613, doi: 10.2021/ma40001126
3	Extrusion of CNT-modified polymers with low viscosity : influence of crystallization and CNT orientation on the electrical properties	Steinmann, W.; Vad, T.; Weise, B.; Wulfhorst, J.; Seide, G.; Gries, T.; Heidelmann, M.; Weirich, T.	Polymers & Polymer Composites 21 (2013), H. 8, S. 473-482
4	The relationship between process technology, structure development and fibre properties in modern carbon fibre production	Wilms, C.; Seide, G.; Gries, T.	In: Pierucci, Sauro; Klemeš, Jirí (Eds.): ICheaP11 : 11th International Conference on Chemical and Process Engineering, 2-5 June 2013, Milano, Italy. - Milano : AIDC Servizi, 2013, S. 1609-1614
5	Structure, properties, and phase transitions of melt-spun poly(vinylidene fluoride) fibers	Steinmann, W.; Walter, S.; Seide, G.; Gries, T.; Roth, G.; Schubnell, M.	Journal of Applied Polymer Science 120 (2011), H. 1, S. 21-35 doi: 20.1002/app-33087