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**Smart** coating systems for process control and increased wear resistance in processing of **Natural Fibre Reinforced** polymers

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Project partners:

Partners from Czech Republic:
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Aim

Rising requirements on polymer injection molding in view to
- process of modified polymers (e.g. natural fibre reinforced polymers)
- high cost pressure
- rising efficiency in production

The process with modified polymers in injection molding causes
- rising wear
- plate-out on active parts of machinery
- worse situation of the molding of modified polymers

Development of multifunctional coating systems
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Kick off meeting of the project in Chemnitz: 22nd of June 2016 at the IWU

First meeting in Zlin; 15th of September 2016 at the Tomas Bata University
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Fabrication of pellets and filaments

Polymer injection molding machine
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Concepts for wear resistant sensor integration
1. Into the extruder: Development of an extrusion die
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Concepts for wear resistant sensor integration

1. Into the extruder: Development of an extrusion die

Two load sensor structures
One temperature sensor structure
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Concepts for wear resistant sensor integration

2. Into the mold: Development of an injection molding die

Mold for the fabrication of polymer-nature fiber filled flooring

Sensor die integration into this area

“wooden-like” tiles
Concepts for wear resistant sensor integration

2. Into the mold: Development of an injection molding die

Integration of sensor dies into three areas of the mold

left side

right side
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Multifunctional layer concept

1. piezoresistive hydrogenated carbon layer DiaForce®
2. electrode structures
3. Si and O modified carbon intermediate layer
4. Cr-meander
5. insulating and wear resistant top layer system

steel substrate
Si and O modified carbon layer as top layer d=3 µm + wear resistant thin film
Cu contacts d=1.5 µm
Cr-meander, conductive path d=0.2 µm
Intermediate layer d=1 µm
electrode structure d=0.2 µm
piezoresistive hydrogenated carbon layer DiaForce® d=6 µm
substrate

+ wear resistant thin film: TiN, TiAlN, WC, …
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First layer system on flat samples

Load sensor structures

Temperature sensor structures

Preparation of the coated substrate for the scanning microscope analysis
1. conductive path between two insulating layers
2. electrode in direct touch with the DiaForce® layer
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