

## Scaffolds for intervertebral disc tissue engineering created by flock technology

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**INTRODUCTION:** Flock technology is a method which has been used in textile technology for a long time but was not applied in the field of biomaterials until now. Flocking offers the possibility to create scaffolds with a high compressive strength despite of high porosity. In this project we are creating a new type of scaffold for intervertebral disc tissue engineering using this technology<sup>1</sup>. Therefore the conventionally used materials have to be replaced by biocompatible and biodegradable ones which have to be electrically conductive to enable flocking.

### **METHODS:** Principle of flock technology:

Flock technology is an old textile technology which is used to produce velvet like surfaces. Flocking means to apply short fibres (0.3-5 mm) to a substrate which is covered with adhesive. The fibres are aligned in an electrostatical field and accelerated versus the adhesive covered substrate. Reaching the adhesive the fibres become stuck perpendicular to the substrate and give an uniform flock coating.

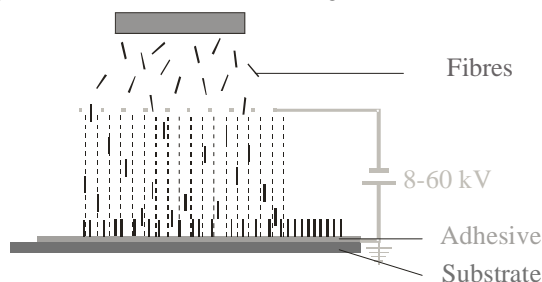


Fig. 1: Principle of the flock process

**Materials:** For flocking a Maag RF 400/500 Flocking Machine (Maag Flockmaschinen GmbH, Gomaringen, Germany) was used. Membranes made of crosslinked and mineralised collagen I were used<sup>2</sup> as substrate. Gelatin from porcine skin (BioChemika, Fluka, Chemie GmbH, Buchs, Switzerland) was used in a 10% solution as adhesive and as a model for Poly(3-hydroxybutyrate) (PHB)-fibres we used Polyamide (PA) -fibres with a diameter of ca. 30  $\mu\text{m}$ . After flocking the scaffolds were chemi-

cally crosslinked with 1% EDC and freeze-dried.

**RESULTS:** The generation of new biodegradable scaffolds using flock technology was possible. The mineralised collagen I tapes are suitable as substrate and gelatin is a possible adhesive for the flocking process. After chemical crosslinking of the gelatin the scaffolds were stable under cell culture conditions.

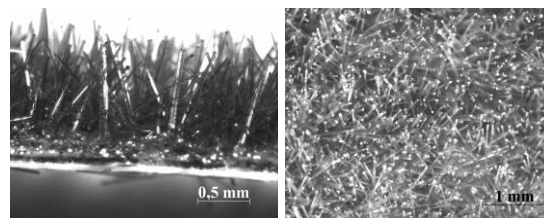


Fig. 2: Pictures of the scaffold (left: cross section; right: top view)

**DISCUSSION & CONCLUSIONS:** It could be shown that flock technology is a suitable method to create scaffolds for intervertebral disc tissue engineering. In further experiments the scaffolds will be characterized mechanically and seeded with chondrocytes and hMSCs for cell culture for several periods of time.

With this technology a variety of different scaffolds for tissue engineering can be produced using other substrates (like chitosan or PHB foils) adhesives (like chitosan, starch or hyaluronic acid) and fibres (like PLA or PGA), respectively. An optimisation of the scaffolds for application in different types of tissues should be possible.

### **REFERENCES:**

- <sup>1</sup> German (DE 10312144.7), European (EP 04005863.8) and US patent (US 10/799,329)
- <sup>2</sup> J.-H. Bradt, W. Pompe et al. (1999) *Chem. Mater.* **11**:2694-2701

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