Limit batch variation by online monitoring

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In the regenerative medicine field, electrospinning is often the preferred production technique due to its capability to produce 3 dimensional fibrous ECM lookalike scaffolds with similar nano- to micrometer length scales using an extensive range of natural and synthetic polymers. The process is highly versatile and tunable, allowing to tailor scaffold properties to fit the demands of the various tissue to be engineered and regenerated.

During the production it is often assumed that a x-amount of polymer feed will result in a defined y-thickness. The really achieved thickness of fibrous scaffolds is normally measured afterwards at the end of the production line. In electrospinning especially for 3D shapes this assumption can lead to large batch to batch variation (Figure 1).

Fig. 1 Optical pictures of some case of heterogeneous thickness while spinning on 3D shapes [1]

IME's contactless thickness measurement technology offers the ability to accurately (σ<10µm) measure the thickness during production also at high fiber collection speeds and allows producing each batch to the desired scaffold thickness to micrometer level (Figure 2) By using multiple measurement locations, each scaffold obtains critical thickness quality checkpoints. This also makes backwards process alterations after final measurement obsolete.

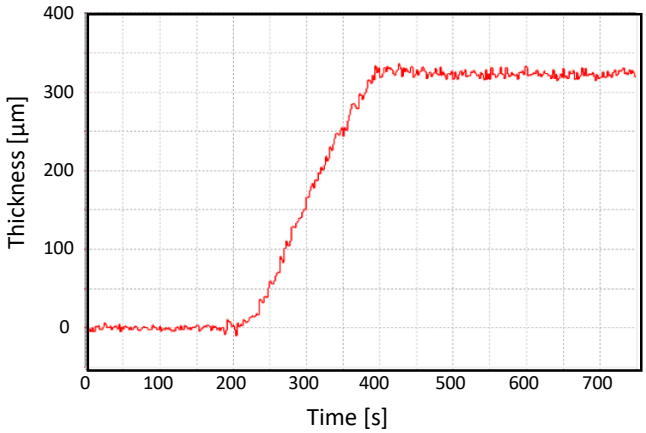

Fig. 2 measured example curve on the thickness during production

The structural and mechanical properties of scaffolds will profit from a uniform and defined thickness. In addition there is a challenge to measure the thickness in a reproducible way, due to the scaffolds porosity inherent compressible nature.
Keeping a tight control the entire production process, also including electric charges combined with online thickness monitoring will reduce variability between and within a batch. In addition, structural and mechanical characterization would profit from a reproducible contactless thickness measurement.

References

[1] M. Simonet (2017) Tailor Electrospinning Techniques for Regenerative Medicine, PhD Thesis, Technical University Eindhoven, Eindhoven, NL