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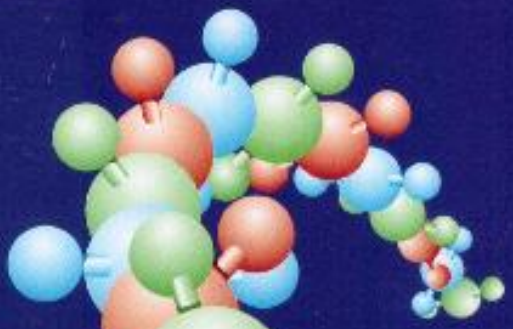

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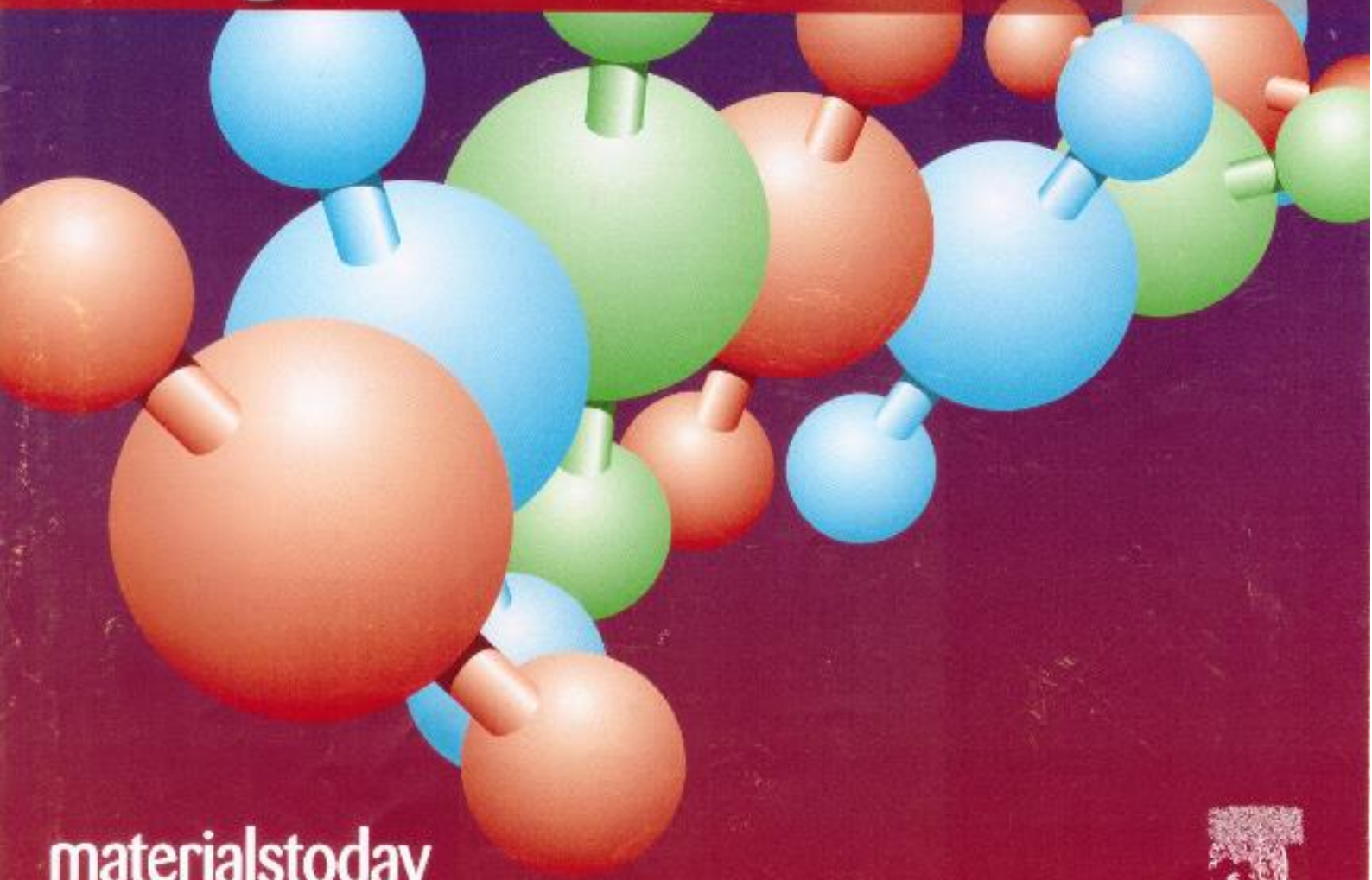

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Effect of voltage polarity on mechanical properties of electrospun PMMA fibers

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The electrospun fibers have unique mechanical properties due to the manufacturing method [1]. Many parameters including the applied voltage polarity used in electrospinning process have significant influence on properties of polymer fibers [2]. Alternating of voltage polarity can be responsible for reorientation of functional groups in polymer chains as charges accumulate at surface of the liquid jet during electrospinning and before solvent evaporation [3]. In our studies we aim to verify the effect of voltage polarity on structural and surface changes of polymetacrylate methyl (PMMA) fiber in terms of their crystallinity and mechanical properties.

In this work, we used PMMA (12 %wt) dissolved in dimethyloformamide (DMF) to produce aligned fibers on the rotating drum (2300 RPM) included in EC-DIF aparatus (IME Technologies, The Netherlands). The applied voltage was +/- 12 kV with solution flow rate at 4 $ml*h^{-1}$, humidity and temperature in the chamber was 40% and 25°C to produce fibers with positive (PMMA+) and negative voltage polarity (PMMA-).

The fiber morphology and diameter were similar for both type of PMMA fibers (1.54 ± 0.22 µm for PMMA+ and 1.69 ± 0.30 µm for PMMA-), however the maximum stress for aligned fibers was 502 and 223 kPa, respectively, see Fig. 1. Similar trend was observed in Young modulus. The increase of mechanical performance of PMMA+ was related to increased crystallinity that was verified with differential scanning calorimetry (DSC).

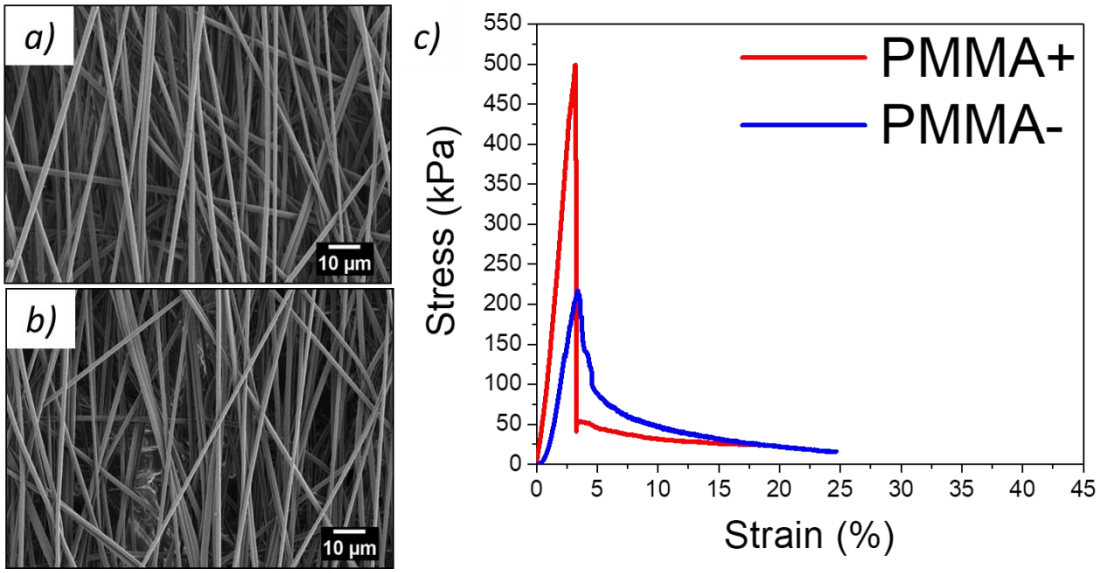

Fig 1.SEM micrographs showing morphology of aligned PMMA fibers produced with a) positive, b) negative voltage polarity and c) corresponding examples of stress-strain curve.

Within this study we showed the potential of controlling mechanical properties of electrospun fibers via voltage polarities during their production as one step manufacturing method, avoiding any additional post-treatment.

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