Cell adhesion and proliferation of skeletal muscle cells on piezoelectric poly(vinylidene fluoride) membranes

Clarisse Ribeiro[1,2], Vitor Sencadas[1,3], Anabela C Areias[1], F Miguel Gama[4] and Senentxu Lanceros-Méndez[1,2]

[1]Centro/Departamento de Física da Universidade do Minho, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal
[2]INL - International Iberian Nanotechnology Laboratory, 4715-330 Braga, Portugal
[3]Instituto Politécnico do Cávado e do Ave, Campus do IPCA, 4750-810, Barcelos, Portugal
[4]IBB – Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal

Contact e-mail: cribeiro@fisica.uminho.pt

Abstract

Several body tissues, including bone and muscle, are subjected to electromechanical solicitations during their functional activity [1-3]. Thus, the use of electroactive polymers as active scaffolds shows innovative large potential for tissue engineering applications as it offers functional resemblance to biological clues [2]. In particular, piezoelectric polymers have shown suitability for tissue engineering due to their ability to vary surface charge when a mechanical load is applied [4] and their possibility to be processed in form of films, porous 2D and 3D membranes and scaffolds and fiber mats. The influence of poling state and morphology (film or fiber morphology) of piezoelectric poly(vinylidene fluoride) (PVDF) on the adhesion and morphology of myoblast cells was studied. Non-poled, ‘‘poled +’’ and “poled-’’ β-PVDF films were prepared by solvent casting followed by corona poling. Further, random and aligned electrospun β-PVDF fiber mats were also prepared. It is demonstrated that negatively charged surfaces improve cell adhesion and proliferation and that the directional growth of the myoblast cells can be achieved by culturing the cell on aligned fibers. Therefore, the potential application of electroative materials for muscle regeneration is demonstrated.