Bridging Microfluidics and Membrane Technology

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SABEU PLASTICS & MEMBRANE TECHNOLOGY

Abstract

The incorporation of membranes into Microphysiological Systems (MPS) has grown significantly. One example is the use of microporous TRAKETCH® membranes in microfluidic systems like organ-on-a-chip. Tissue-culture treated membranes are excellent supports for cell growth[1]. To select the best membrane for a MPS it is important to consider the fabrication method, material, porosity and surface modifications[2]. In this work we would like to shed light on the technology and science behind microporous membranes, and their benefits for regulatory acceptance.

Technology

TRAKETCH® membranes are produced from ultra-thin PC and PET films, that are bombarded with accelerated noble gas ions (**Figure 1**).

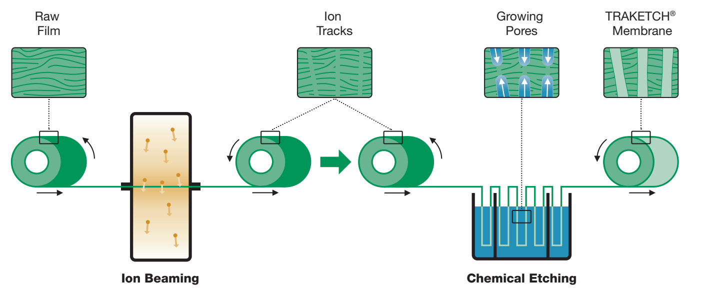

Figure 1. *Schematic representation of TRAKETCH® membrane manufacturing process.*

The goal is to break the molecular chains of the polymer to create ion tracks that are clearly defined by their density and angles (**Figure 2**).

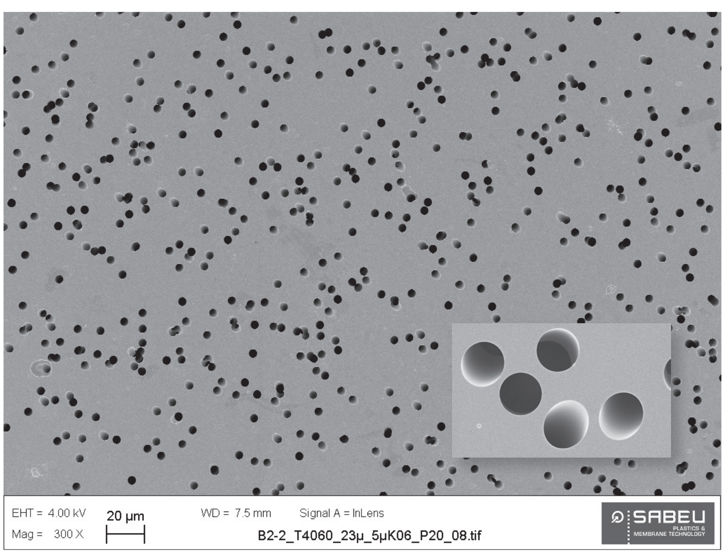

Figure 2. *Electron microscope image of a TRAKETCH® membrane.*

The desired pore density is accurately determined by the ion beam intensity and the film velocity. The defined pore angles and precise control of the pore density contributes to the superior optical clarity of the membrane. Afterwards, the ion tracks are chemically etched into pore channels. The diameter of these pores can be determined with sub-micrometer accuracy. Finally, membranes are treated with air plasma to promote optimal cell attachment.

Application Examples

TRAKETCH® membranes are produced in-house by SABEU, guaranteeing 100 % parameter consistency and are integrated in our line of cell culture inserts[3] and in recent innovative organ-on-a-chip platforms supporting the 3D growth of human mature adipose tissue[4] and the creation of an oviduct-on-a-chip[5]. Cells grown on MPS containing microporous membranes (such as cellQART®), have access to nutrients from the apical and basolateral side. This allows the separation into two compartments, simulating the physiological condition where the cell layer acts as a diffusion barrier. Due to the physiological relevance of this model, it is possible to mimic the complexity of human relevant systems and tissue barriers, such as the lung ephitelium (**Figure 3**)[6], imposing benefits for regulatory acceptance.

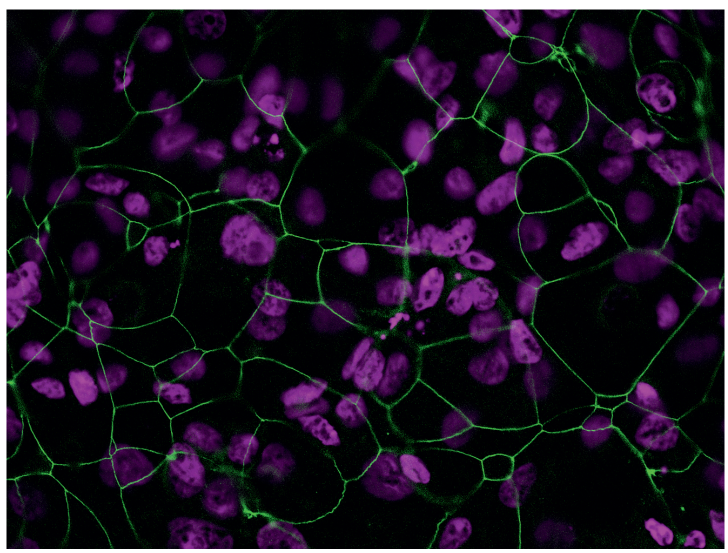

Figure 3. *Tight junction formation on cellQART® inserts by InSCREENeX[6].*

Conclusion

We are aware of the urge for scientific collaboration and inclusion of manufacturers in the process of developing new MPS methods. As original manufacturer, we are actively looking for opportunities, collaborations and projects that can benefit from our expertise on the production of microporous membranes and plastics.

REFERENCES:
1. Chung et al. Lab Chip. 2018 Jun 12; 18(12): 1671–1689. | 2. Jong et al. Lab Chip. 2006 Sep;6(9):1125-39. | 3. www.cellqart.com | 4. Julia Rogal et al .Sci Rep. 2020 Apr 20;10(1):6666.
5. Marcia Ferraz et al, Nat Commun. 2018 Nov 22;9(1):4934. | 6. InSCREENeX :: cellQART®. www.cellqart.com/applications/inscreenex.