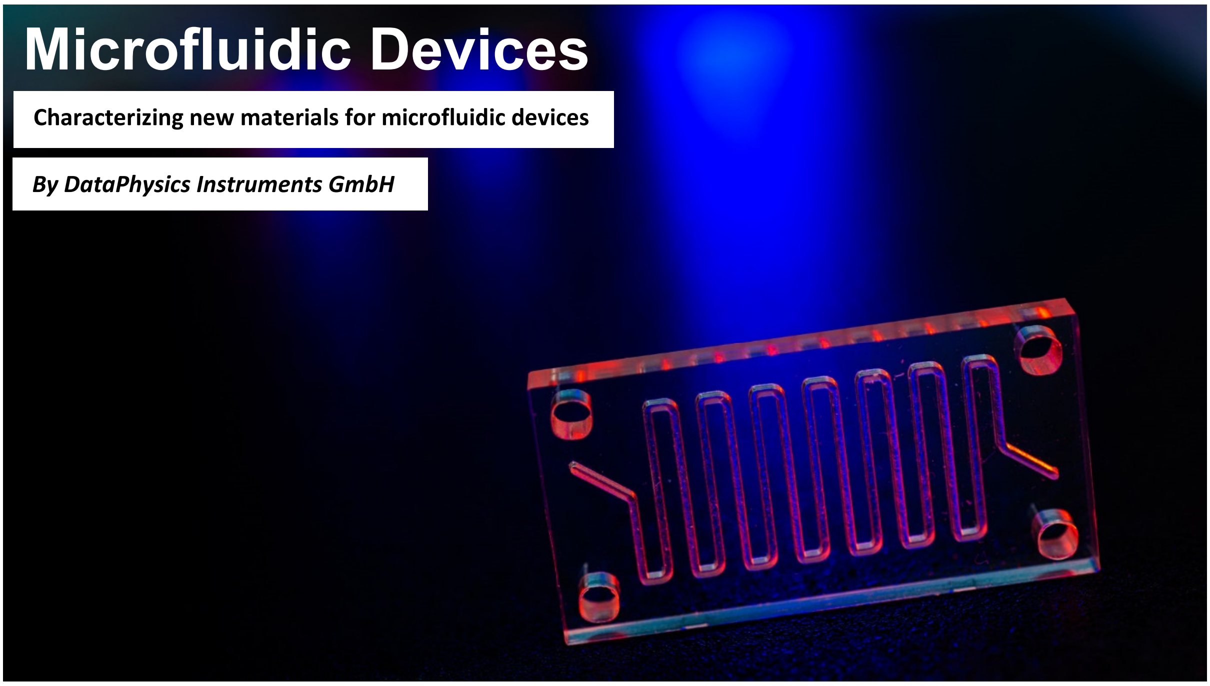
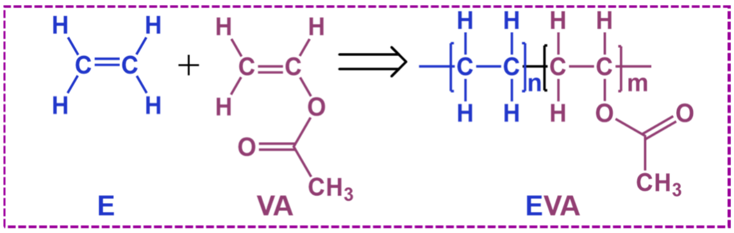
How contact angle measurements can help to improve microfluidic devices



Microfluidic devices are an emerging technology that has attracted considerable attention owing to its important applications in various fields like biomedical engineering, chemistry and physics amongst others. Especially, microfluidic chips have become an essential analysis tool in point-of-care testing (POCT) devices benefiting from a low cost and broadly accessible methods for the fabrication of microfluidic devices. PDMS is one of the most common materials to fabricate microfluidic devices due to its excellent features such as, flexibility, biocompatibility, etc. However, the fabrication of microfluidic chips with PDMS is time-consuming, costly and the transmission behaviour in the IR range is quite low limiting the applicability in some cases. In order to better satisfy the requirements of microfluidic applications, the search for new techniques and materials is still ongoing. An interesting alternative to PDMS is ethylene-vinyl acetate (EVA) which is not only much cheaper than PDMS, but also possesses most of the favourable properties from PDMS and even more beneficial features like a good transparency in IR and visual range. Recently, Annabestani et al. reported that EVA can be used as a new alternative for PDMS to fabricate microfluidic chips, with advantages regarding economic, ease of use, and new features in fabrication and functionality (**Scheme 1**).



Scheme 1. *The chemical structure of EVA.*

Amongst the key parameters for a good material in the field of microfluidic applications is their wettability. Previous works showed that materials with a highly hydrophobic character such as PDMS lead to a slower fluid flow and increased risk of channel blocking. To clearly understand the wetting behaviour of EVA, contact angle (CA) measurements on PDMS and EVA were conducted. As **Figure 1** illustrates, EVA has a much smaller CA compare to PDMS, indicating that EVA is less hydrophobic and more wettable than PDMS. This leads the effect that the EVA microfluidic chips can work faster and are very seldomly blocked.

Figure 1. *Water contact angle measurement on PDMS and EVA.*

Furthermore, beside the above advantages of EVA, EVA based microfluidic chip also showed less fabrication time, very good biocompatibility, geometrical modifiability, ubiquitousness, and good mechanical behaviour.

Overall, this work introduced EVA as a new material for the fabrication of microfluidic chips. Compare to PDMS, EVA has distinct advantages, such as, low cost, ease of use, and geometrical modifiability. In addition, EVA displayed a lower hydrophobicity than PDMS, that facilitates a faster and more efficient flow without channel blocking in EVA chips. All of these advantages make EVA a promising material for application in POCT. Besides, EVA showed very good bio biocompatibility as well as good transparency in terahertz range, which provide more new ideas for designing sensing and diagnostic devices.

An optical contour analysis system OCA (DataPhysics Instruments GmbH, Germany) was used in this research.

For more information, please refer to the following article:

A novel, low cost, and accessible method for rapid fabrication of the modifable microfluidic devices; Mohsen Annabestani, Pouria Esmaeili-Dokht, Mehdi Fardmanesh; *Sci. Rep,* **2020**, 10, 16513*;* DOI: https://doi.org/10.1038/s41598-020-73535-w.