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MATERIALS SCIENCE AND TESTING OF POLYMERS
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Mechanical characterization of polymer-interfaces

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Nanoindentation on PE-EVOH-PE pipes

Layered and structured materials have especially interesting mechanical properties. The structure can be used to modify fracture behavior massively. For this, the mechanical properties of the materials, and their change over the interface are of high interest. Nanoindentation can be used to measure even the smallest mechanical difference. The result in form of the indentation modulus is directly proportional to the Young´s modulus. In Figure 1 the results of nanoindentation with different maximal forces is shown on a PE-EVOH-PE pipe segment.

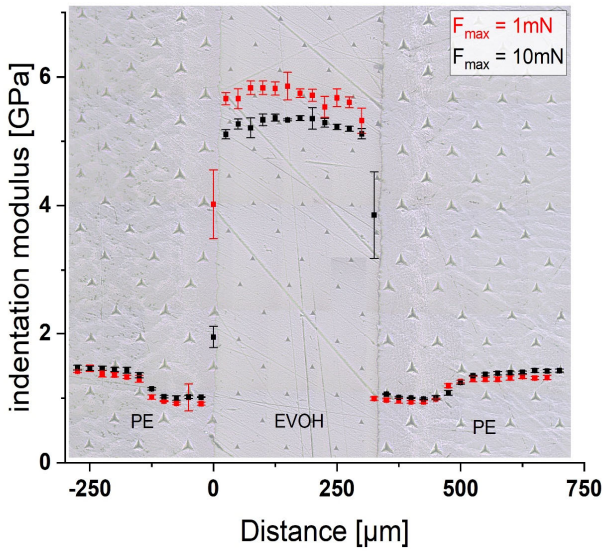
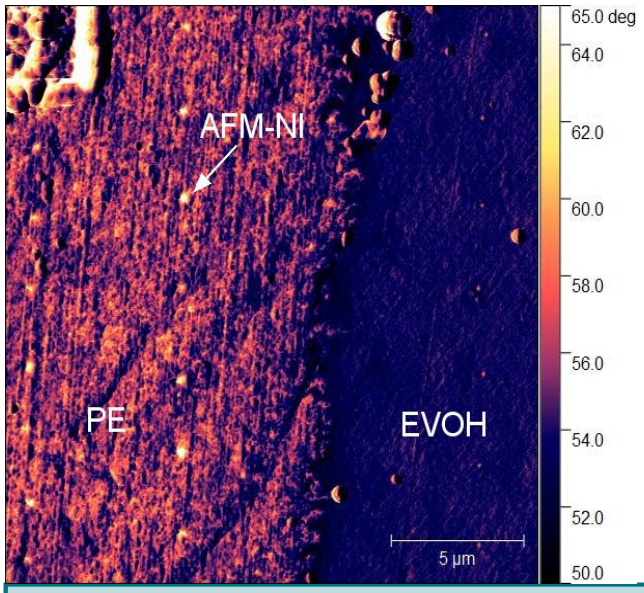


Fig.1

Nanoindentation over the PE-EVOH interfaces. Even the small difference between HD-and LD-PE could be made visible with the measurement. The smaller Fmax leads to a more accurate measurement, as long as the surface properties are similar to the bulk properties.



The difference seems minimal, but for fracture behavior it is necessary to consider even the slightest modulus difference, so the chosen testing force is of highest importance. Another way to measure small deviations of the modulus is atomic force microscopy (AFM), as seen in Figure 2. The obtained Phase shift is a direct result of the different hardness from the materials and can be used to identify the interface easily. Together, Nanoindentation and the versatile AFM-methods are perfect to characterize even the smallest structures.

Fig. 2

AFM-Phase image of one of the PE-EVOH interface seen in the background of Figure 1. The resulting Phase-Shift for the softer PE is bigger than for harder EVOH. Also effects of AFM-based Nanoindentation (AFM-NI) can be seen.

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