NEW DEVELOPMENT OF A MICROINDENTATION SYSTEM TO DETERMINE MECHANICAL PROPERTIES OF POLYMERS

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Indentation techniques such as static hardness testing on macro- micro- or nanoscale as well as dynamic nanoscale indentation for viscoelastic properties are available. However, a microscale dynamic indentation method is not available on the market today. The aim of this study is to present a quasi-static and a dynamic microindentation method to determine viscoelastic properties with a conventional Dynamical Mechanical Analysis (DMA). A tungsten needle for quasi-static and 3 standard diamond indenters for dynamic microindentation were used to perform indentation measurements on Polycarbonate (PC), Polybutadienterepthtalat (PBT), Thermoplastic polyurethane (TPU) and annealed and unannealed Polypropylene (PP). The results of this study showed that different polymers and small inhomogeneous mechanical properties distribution can be distinguished very well by quasi-static microindentation. Furthermore, the measured complex moduli from the dynamic microindentation with different diamond indenters were all in good agreement with the 3-point bending moduli and the literature values. In summary, this study showed that the proposed quasi-static microindentation and the dynamic microindentation methods are very suitable to determine local mechanical properties of polymers on a microscale level.