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Recent Progress in Microwave Assisted Processing of Polymers – Fundamentals and Machinery Development

*Jan Diemert, Rudolf Emmerich, M. Graf, Peter Eyerer

Fraunhofer Institute for Chemical Technology ICT, D-76327 Pfinztal, Germany

Microwaves are a promising alternative energy supply for the processing of polar polymers. A successful technical application of microwave technology in the plastification of polymers necessitates a better understanding of the behaviour of the polymer in a microwave heating process. Due to the different chemical structure of the polymers the absorption level can be very different. Furthermore measurements often can not be limited to the base polymer due to the larger amounts of additives, fillers or fibres added to the compound. New extensive measurements carried out on different polymers, additives and fillers show the potential of two new measurement devices developed recently, both allowing the precise characterisation of the dielectric properties of differently shaped polymer materials, like powders, granules or liquids. The measurements show for example for the most important components of PVC-dryblends - PVC-base polymers, lubricants, stabilizers and fillers - significant differences in the microwave absorption levels of these substances. The effect of different absorption levels of the polymers or additives also result in different microwave absorption of the compound. In order to use microwave as a third source of energy - beside thermal and mechanical energy transfer - different concepts of applying microwaves to a metering kneader were studied. The presented microwave assisted metering kneader allows the plastification of PVC using microwave energy under real processing conditions. The results obtained and the efficiency of this prototypes promise a faster plastification of polymers using microwave technology compared to conventional energy transmission.