



**DEVELOPMENT OF POLYMER/INORGANIC NANOCOMPOSITES PROCESSING BASED ON AN
IN-SITU NON-AQUEOUS SOL-GEL TECHNOLOGY**

W. Michaeli^a, Ch. Hopmann^a, C. Kremer^a, E. Klueker^{a,*}, M. Moeller^b, K. Peter^b

^a Institute of Plastics Processing (IKV) at RWTH Aachen University, Pontstrasse 55, 52062 Aachen, Germany and ^b DWI at RWTH Aachen University, Pauwelsstrasse 8, 52056 Aachen, Germany.

*Corresponding author: kluenker@ikv.rwth-aachen.de

Polymer composites containing nanoparticles have shown to exhibit properties which are superior to those of microparticle blends. In contrast, conventional top-down nanocomposite compounding, e.g. based on clay as source of nanosized particles, is handicapped by high viscosities and the difficulty to achieve a homogeneous particle distribution without agglomeration. In this paper, we present a new bottom-up concept for preparing polymer nanocomposites based on in-situ formation of silica nanosized particles in a polypropylene matrix during processing. Non-volatile, hydrophobic hyperbranched polyalkoxysiloxanes (PAOS) are employed as silica precursors, which can be tailored for optimum compatibility and processing of polypropylene. After mixing the silica precursor in the polymer melt, silica particles are formed in-situ by a condensation reaction. The developed non-aqueous sol-gel technology is transferred from discontinuous laboratory scale to a continuous process using a 26 mm co-rotating intermeshing twin-screw extruder. The resulting nanocomposites are further processed by injection moulding. A detailed analysis focuses on morphology and component properties as well as on nucleation, stiffness and improved impact strength of the composite material. Furthermore, the composite material will be compared to a commonly available polypropylene nanocomposite based on a polypropylene/silica masterbatch. Investigations in laboratory scale as well as first trials in a twin-screw extruder have shown that a successful conversion from PAOS to silicate can be achieved. Silica particles thereby feature a size of less than 100 nm and a suitable distribution within the polymer matrix. The first results underline the high potential of the newly developed route for nanocomposite production.