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POLYPROPYLENE BASED BLENDS FOR LASER SINTER TECHNOLOGY

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Commonly polyamide (PA) is mainly used as the polymer basis for the production of technical parts in laser sinter technology belonging to the most important rapid prototyping technologies. For laser sintering of polymer materials the polymer should be characterized by some general properties induced by the specific processing method. Hence, a free flowing polymer powder as the initial material state must be available, a high energy absorption and quick transition in the melt state is necessary, and the coalescence of the molten droplets in a rather short time has to run effectively. Furthermore, the physical and mechanical properties should allow a wide application range of the laser sinter products. In comparison to PA the application of polypropylene (PP) for laser sintering does not lead to satisfying results until now. Therefore, the goal of actual research is the development of PP based materials, which can fulfil the requirements for laser sinter materials concerning both processing behaviour and application properties. Furthermore, also from economical reasons the development of a polyolefin based laser sinter material is of essential interest.

Because propylene homo-polymers cannot fulfil the high demands made on laser sinter polymers, and propylene copolymers are also not easily to adapt to the laser sinter technology, specific PP based blends were developed and tested for laser sintering. At first, an assessment of applicability of the polymers for the laser sintering process was necessary. For this purpose thermal and rheological analysis, FTIR spectroscopy, and granulometric experiments were performed. The majority of the PP investigated turned out to be potential materials for laser sintering. Strong differences in the materials behaviour influencing the laser sinter processability have been found concerning the degree of crystallinity, the capability to absorb the laser energy, and the particle size distribution. Strategies for the modification of PP grades were developed for adapting the material to laser sintering technology. Some PP based blends will be introduced, which were generated by melt mixing in twin-screw kneader. PP copolymer was used as basis component, and different copolymers, e.g., ethylene-α-olefin copolymers, propylene-ethylene copolymer as a further blend component. Maleic anhydride functionalized PP was applied as compatibilzer.

For the development of innovative PP based laser sinter materials it is essential to provide the most important mechanical properties like impact and tensile strength as well as stiffness without any loss or detraction of the sinterability of the polymer material. Therefore not only the recipe but also the technological design of the blend mixing and laser sinter process is of great importance. In this connection the influence of the technological parameters of the compounding process performed by means of a twin screw kneader on the physical and mechanical properties of PP sinter material was investigated. Experimental results generated in lab-scale were compared and verified with practice-relevant tests performed with an industrial laser sinter station.

Fiedler, L.; Garcia Correa, L.O.; Radusch, H.-J.; Wutzler, A.; Gerken, J., Evaluation of Polypropylene Powder Grades in Consideration of the Laser Sintering Processability, Zeitschrift Kunststofftechnik, 3 (2007) 4, 1-14